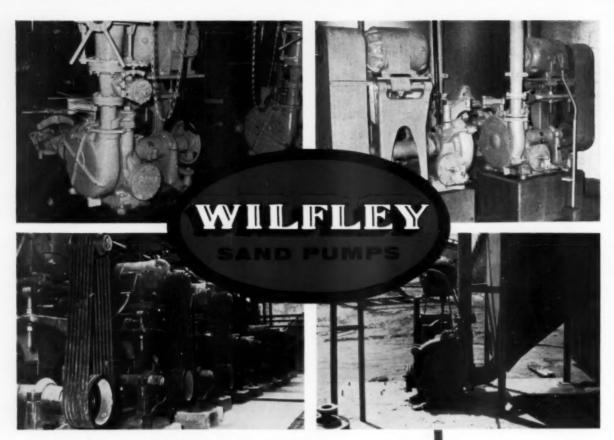
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## **COMING EVENTS**

- July 27-29, Seventh Annual Institute, Rocky Mountain Mineral Law Foundation, Albuquerque, N. M.
- Aug. 1-15, VII General Assembly of the Pan American Institute of Geography and History, Buenos Aires, Argentina.
- Aug. 28-Sept. 1, ASME—University of Colorodo International Heat Transfer Conference, University of Colorado, Boulder, Colo.
- Sept. 11-14, American Mining Congress Metal Mining—Industrial Minerals Convention, Olympic Hotel, Seattle, Wash.
- Sept. 14-15, ASME-AIEE Engineering Management Conference, Roosevelt Hotel, New York City.
- Sept. 17-20, Commemoration of the 50th Anniversary of Froth Flotation in the U.S.A., sponsored by AlME: Society of Mining Engineers' Minerals Beneficiation Division, Brown Palace and Cosmopolitan Hotels, Denver.
- Oct. 2-3, Joint Meeting, Industrial Minerals Division of SME of AIME—CIM, Chateau Laurier Hotel, Ottawa.
- Oct. 3-4, Southern Research Institute, Dinkler-Tutwiler Hotel, Birmingham.
- Oct. 5-7, AIME-ASME Joint Solid Fuels Conference, Dinkler-Tutwilor Hotel, Birmingham.
- Oct. 18-21, AAPG Mid-Continent Regional Meeting, Amarillo, Texas.
- Oct. 25-27, 11th Annual Meeting Gulf Coast Assn. of Geological Societies, Granada Hotel, San Antonia, Texas.
- Oct. 25-28, 14th Pacific Coast Regional American Ceramic Society Convention, Jack Tar Hotel, San Francisco.
- Nev. 1-3, Southwestern Federation of Geological Societies Fourth Annual Meeting, El Paso, Texas.
- Nov. 3, Pittsburgh Sections of AIME and NOHC Off-the-Record Meeting, Penn-Sheraton Hotel, Pittsburgh.
- Nev. 3-4, Joint Meeting Central Appalachian Section, AIME and the West Virginia Coal Mining Institute, The Greenbrier, White Sulpher Springs, W. Va.
- Nev. 4, Carolinas Section, AIME, annual meeting, Barringer Hotel, Charlotte, N. C. For information write Neil O. Johnson, Foote Mineral Co., Kings Mountain, N. C.
- Nov. 5-9, 31st Annual International Meeting of the Society of Exploration Geophysicists, Denver.
- Dec. 4, Annual Meeting Arizona Section of AIME, Pioneer Hotel, Tucson, Ariz.
- Dec. 6-8, Nineteenth Electric Furnace Conference, sponsored by The Metallurgical Society of AIME. Penn-Sheraton Hotel, Pittsburgh.
- Feb. 18-22, 1962, AIME Annual Meeting, New York City.
- Mer. 26-29, AAPG-SEPM Annual Meeting, jointly with AAPG-SEPM-SEG Pacific Sections, Civic Auditorium, San Francisco. Fairmont Hotel to be hotel headquarters.
- Apr. 9-11, 45th National Open Hearth and Blast Furnace, Coke Oven and Raw Materials Conference, sponsored by The Metallurgical Society of AIME. Sheraton-Cadillac Hotel, Detroit.
- Apr. 12-14, Pacific Southwest Mineral Industry Conference, Palace Hotel, San Francisco.
- Apr. 23-25, 12th Annual Meeting, Rocky Mt. Section, AAPG, Salt Lake City.
- Apr. 26-28, AIME Pacific Northwest Metals and Minerals Conference, Ben Franklin Hotel, Seattle, Wash.
- May 7-9, American Mining Congress Coal Convention, Pittsburgh.
- June 7-8, Coal Division Field Meeting, Price,



VOL. 13 NO. 7

**JULY 1961** 

COVER Many years ago, Edgar Franklin Wittmack was eminently successful in putting the "story-book" prospector to canvas. We do not know who served as Mr. Wittmack's model, but this same man served again to inspire artist Herb McClure's rendition of this month's cover. But this is history—for a list of today's SME members in the mineral industry, see page 719.

#### ARTICLES

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- 690 Central Washeries . . . Key to India's Coal Problem
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In addition to the listings below, ESPS maintains a more complete file of general engineering positions and men available. Contact neurest ESPS office, listed above.

## MEN AVAILABLE

Purebasing Manager of mining equipment and manufacturing, age 50, Cornell '35, Reg. P. E. Location, domestic or foreign. M-617.

Open Pit Mining Supervisor, B.S. Geol., age 44. Fourteen years experience open pit mining, exploration, surveying, mapping, calculation of ore reserves, some underground mining. Prefer South, Southwest, and foreign. M-618.

Mining-Quarry-Production Engineer, B.S. mining engineering, age 26. Two years in large quarry operation. Thorough knowledge drilling and blasting, stripping and haulage operations, maintenance, production, supervision, planning, costs, report writing. Prefer Midwest, West, East, Canada. M-2192-Chicago.

Plant Supervisor, mining background, age 51. Thirty years experience mostly as super-intendent ore dressing, rotary and hearth kiln operations, also production planning, specification control, cost control, preventative maintenance. Prefer West. Home: Arizona. \$650. Se-1823.

Chief Engineer, Superintendent, M.E. degree age 31. Over seven years experience including construction and maintenance of all mining facilities, plan engineering and design construction activities of mine and mill, supervise work required for water supply, layout and plan all future mining operations, supervise miners, supervise exploration crews, mine surveying, computing ore reserves, layout trackwork and haulage roads. Prefer Northwest states. Home: Montana. \$650. Se-1719.

Superintendent, Shift Foreman, geological engineering, age 34. Almost 11 years experience in variety of mine operations and engineering problems, geologic work, field examinations and explorations techniques. Prefer West. Home: Nevada. \$700. Se-1678.

Superintendent, Assistant Superintendent, mining engineering, age 33. Eight years experience in mining, maintenance, and benefication at large scale open pit iron ore mines. Six of these years in supervisory position. Prefer California or western U.S. Home: Minnesota. \$10,000. Se-1603.

Engineer, Geologist, mining geologist, age 49. Twenty-six years varied engineering and geology experience. 17 years overseas in 16 countries, experienced in development, exploration, consulting and report writing. Prefer any location. Home: California. Se-1533.

Superintendent, Foreman, mining engineering, age 36. Eleven years experience in

pillar recovery mining, supervise roof support and ventilation work, some drafting and examination of mining properties. Prefer West. Home: New Mexico. \$10,000 Se-1321.

Manager, Superintendent, mining engineering, age 48. Registered professional engineer. Twenty-four years experience in western mines in all phases (copper, zinc, chromite, gold, vandium) operations, design and installation of all types mining small scale through black caving, also small scale open pit operation. Prefer West or foreign. Home: Montana. Se-1151.

Mine Engineer, Geologist, mining geologist, age 37. Ten years in geology and exploration with operational experience in copper mining. Experience in laying out and supervising exploration and drilling programs. Prefer West. Home: Philippine Islands. \$900.

Geologist, age 37. Over five years experience in exploration evaluation numerous metallic and nonmetallic mineral deposits, study of sait bed geology. Eight months experience examining uranium properties. Over three years in geological field mapping, sub-surface geological studies and well siting in petroleum. Prefer California, Nevada. Home: Colorado. \$9500. Se-349.

Production Maintenance Supervisor, geological engineer age 34. Two years supervisory experience in cement plant. Five years in charge of engineering, plant maintenance, and in related gypeum production. Prefer West. Home: Texas. \$700. Se-185.

Product, Production Engineer, M.E., I.E., age 31. Over two years experience in all phases of mechanical and structural design for chemical, oil and power plants including structures, foundations pipe stresses, pressure drops, electronic computor programming. Two years in charge of technical office. Complete responsibility for design and selection of new industrial equipment and utilities and modernization of existing facilities. Prefer West or foreign. Home: Missouri. \$8500. Se-114.

#### POSITIONS OPEN

Director of Industrial Engineers, B.S. degree in mining, mechanical or industrial engineering, with M.S. advantageous, with 10 years experience in industrial engineering including five years in a supervisory position. Experience must cover industrial engineering techniques such as time and motion study, ratio delay, methods engineering, wage incentives, cost accounting, etc. Employment on contact basis in multiples of two years, home leave vacation of two months at end of two year contract. Transportation both ways. South America. F361.

Mining Engineer, young, with experience on stripping operations for pegmatite project. \$8000 year. Brazil. F352.

Staff Engineer, Beneficiation, 30-50, with minimum of 15 years experience, graduate or professional engineer, thoroughly experienced in ore beneficiation as applied to the iron and steel industry. Must be capable of assuming consulting or supervisory duties. Midwest. W298 a).

Mining Graduate Engineer, 35-45. Minimum of five years experience in administrative functions of mining operations including costs, mining, maintenance of equipment, etc. for stone quarry. \$10,000-\$11,000. Employer will pay placement fee. Forty miles southwest of Chicago. C8662.

Exploration Geologist, \$450 plus room, board, and traveling expenses, liberal vacation, retirement, and up to 10 pct bonus. Company pays local income tax in Central America. Prefer single man with some knowledge of Spanish. Sj-6154.

Production Engineer, \$8000-9000, in Nevada, ME, Met, IE, Chem. E., age 25-30. Three to five years smelting and refining nonferrous metals, experienced in ingot production, process procedures, quality control, general metallurgy, reduction plant layout involving heavy crushers, leaching, chlorine, vacuum arc furnace melting and heavy bulk materials handling from ore to ingot. For a large mill. Sj-6111.

Mineral Dressing Engineer, recent graduate with original ideas, to develop improved beneficiation procedures and new uses for wide variety of industrial minerals. Pleasant working conditions in well-equipped growing research organization. Salary open. Southwest. W428.



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Scientific Thinking and Scientific Writing by Martin S. Peterson, Reinhold Publishing Corp., 1961, 215 pp., \$6.95-Addressed mainly to students in the biological and physical sciences, this book is based on the premise that good expository prose cannot be written without knowledge and application of the general logic of science. To instill these requisites, Dr. Peterson here presents the essence of traditional inductive logic, the logic of several special methods, the role of hypothesis, and the general pattern of complete scientific investigation in relation to the development of a professional background for scientific writing. The final chapter of the book de-scribes various types of scientific writing and thinking. . . .

Past Examinations for Professional Engineer, 1961 Edition, compiled and published by John D. Constance, 625 Hudson Terrace, Cliffside Park, N. J., 1961, various pagings, \$1.50—This is a compilation of past examinations for Professional Engineer given by the New York State Board of Examiners during the period January 1953 to February 1961. Over 1000 questions in all categories are given. Structural planning and design, basic engineering sciences, and individual categories of engineering are covered in the text.

Correlation Method of Refracted Waves, USSR Academy of Sciences, OTS U.S. Dept. of Commerce, Washington 25, D. C. Order No. 60-11607, 1961, 343 pp., \$3.50—This is a translation of the first systematic, comprehensive geophysical study describing the development and application of a technique devised by Soviet scientists as an aid in Russia's continuing search for new petroleum, coal, and ore deposits. The first chapter explains the principle, which is a modification of older seismographic techniques, and features observation by

multichannel seismic stations coupled with improvements in seismographs, amplifiers, and galvanometers. The principles of phase correlation of waves are used in recording seismograms; the dynamic characteristics of the waves are more widely used than in the reflected wave method; and the correlation method of refracted waves makes it possible to combine the correlation method of refracted waves technique with the method of reflected waves.

Mechanized Cutting and Loading of Coal by R. Shepherd and A. G. Withers, Odhams Press Ltd., 24 Henrietta St., London W.C.2, England, 1961, 328 pp., approx. \$7.00 (50s.)-Constructional and operational details of coal-cutting and loading machines are classified and analyzed. Following a historical review of the subject, the principal British and a number of non-British machines are described and illustrated. Subsequent chapters deal with cutting tools, electrical equipment, safety and health aspects, design and operational problems, typical installations, experimental machines, and possible future developments.

Mining and Petroleum Legislation in Latin America, Vol. I South America, Pan American Union, Washington, D. C., 1958, 180 pp., \$5.00—This volume presents a summary, with commentary, of the significant provisions and principles governing the various aspects of the mineral industries. The organization of the material is by country, with separate sections on mining and petroleum, each section covering topics pertinent to that particular country.

Rare Metals Handbook edited by Clifford A. Hampel, 2nd Edition, Reinhold Publishing Corp., 1961, 715 pp., \$20.00-A revised and expanded edition of a handbook that presents currently available data on 55 of the less-common metals. In this edition six essentially new metals are added. A new format facilitates reference to such aspects as occurrence, production statistics, economics, latest methods of production from ores or other raw materials, chemical and physical properties, alloys, fabrication techniques, and present and potential uses. Comparisons between metals are shown in convenient tabular form. . . .

Compressed Air and Gas Handbook. 3rd Edition, edited and published by Compressed Air and Gas Institute, 55 Public Square, Cleveland 13, Ohio, 1961, 592 pp., \$8.00-This handbook is directed to all who have an interest in compressed air and gas equipment. This new edition has been almost completely revised and rewritten to include many topics of increasing interest such as materials handling systems, air circuitry and controls, specialty tools, automation components, and process gas compressors. There is a complete, up-to-date discussion of the various types of compressors and of pneumatic tools of both industrial and constructive types, with well illustrated examples of their application. Wherever possible, tables and graphs are used, and the text is carefully indexed and cross-referenced to assure its utmost usability. . . .

Key to Smoley's by George F. Wolters, P. O. Box 475, Ormond Beach, Fla., 1960, \$1.50—This booklet has been designed to simplify the understanding of the various C. K. Smoley's mathematical tables. Many draftsmen who use the Smoley logarithmic tables do not fully realize their usefulness. The present booklet, with its graphic examples and solutions and their respective application to the Smoley's tables help even those with the weakest mathematical background to master the tables and do his calculations with speed and accuracy.

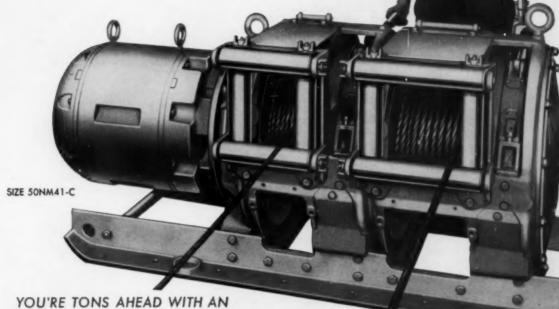
Mining Yearbook—1961 Edition, compiled and published by W. E. Skinner, 20 Copthall Ave., London, E.C., 2, England, 744 pp., \$7.00 post free—Published for the 75th consecutive year, this book contains details of 1000 principle mining and metal companies around the world. Also included are tables of world production of gold and base metals for the past three years, as well as a "Buyers' Guide" comprising more than 2000 headings and entries of equipment manufacturers and suppliers, and dealers of ore.

Principles of Stratigraphy by Amadeus W. Grabau, Dover Publication, 180 Varick St., New York 14, N.Y., 1961, 2 vol., 1185 pp., paperbound, \$5.00—Initially published in 1913,

(Continued on page 652)



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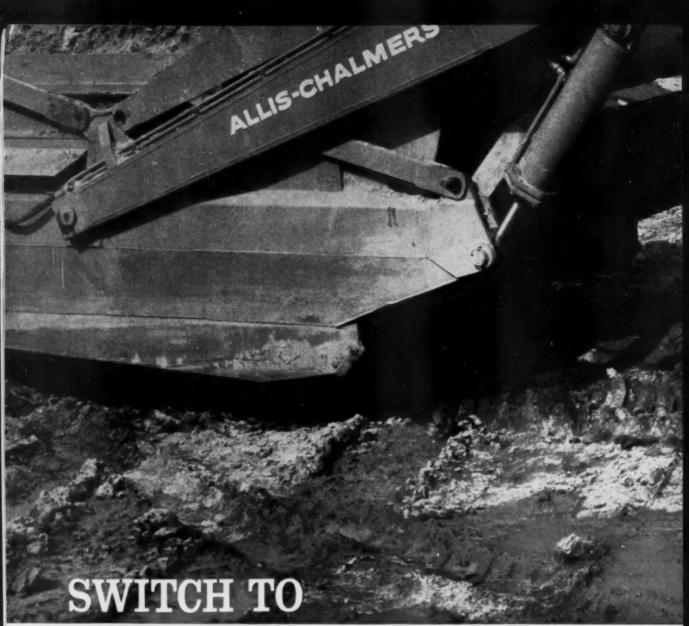
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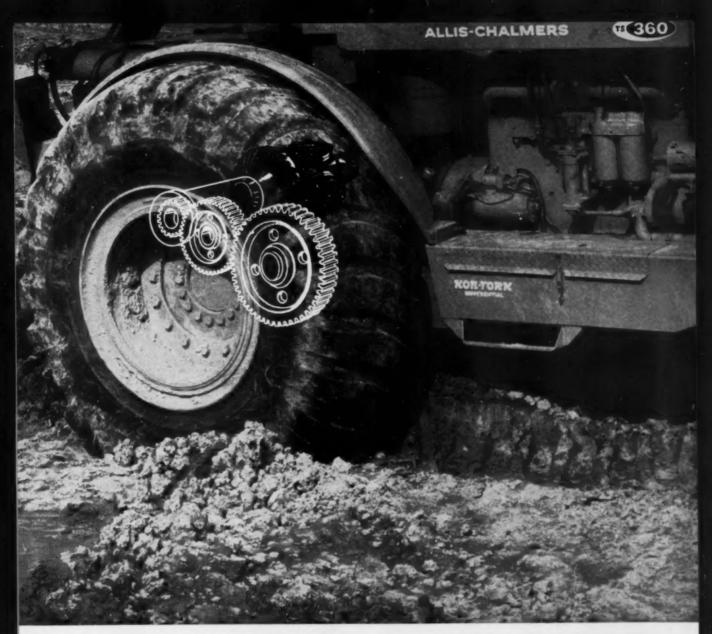
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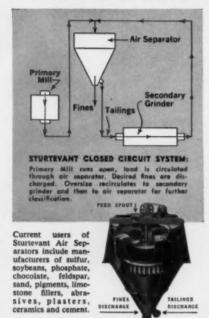
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BOOKS

(Continued from

page 648)

this classic work in the field of geology has been republished in an unabridged edition of the 1924 revision by A. G. Seiler. It contains bibliographies with a total of 1277 entries. 264 diagrams, and a new introduction by Marshall Kay, Professor of Geology, Columbia University. This basic reference book contains 600 pages devoted to the structural character and lithogenesis of rock types and formations and the remaining portion includes discussion of the forces of deformation and diastrophism. . . .

Mine Ventilation and Air Conditioning by Howard L. Hartmen, Ronald Press Co., 15 E. 26th St., New York 10, N. Y., 1961, 432 pp., \$12.00-A manual containing the successful principles and practices in mine atmosphere control, this book describes in terms of actual operating facilities the preferred techniques for quantitive and qualitative control of air, temperature, humidity, gases, and dust. Applicable to both coal and metal mines, the material includes basic mine ventilation circuits, ventilation equipment and systems, temperature-humidity control sys-tems, and instrumentation for air measurement. Each topic is fully illustrated with detail drawings, and an extensive bibliography of important technical literature is keyed to the topics covered. . .

#### U.S. BUREAU OF MINES

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Preprint from Bureau of Mines Minerals Yearbook 1959—The Mineral Industry of South Carolina, 10¢. List of Journal Articles by Bureau of Mines Authors Published July 1, 1910 to Jan. 1, 1960, \$1.75. 1960, \$1.75. List of Publications Issued by the Bureau of Mines from July 1, 1910 to Jan. 1, 1960. 84.25.
Bull. 585 Mineral Facts and Problems—
Perlite, 10g; Sand and Gravel, 15g; Silicon,

10¢: Steel, 20¢: Stone, 15¢ Titanium, 15¢; Tungsten, 35¢: Vermiculite, 10¢ Yttrium, 5¢. Bull, 586 Historical Summary of Coal-Mine Explosions in the U.S., 1810-1958, 81.75. Bull, 587 Design of Underground Openings in Competent Rock, 30¢. Mine Ventilating Principles and Fractices, 40¢. Bull, 580 Control of Fires in Inactive Coal Formations in the U.S., 60¢. MC 51 Injury Statistics as an Aid in Preventing Accidents in Metal and Nonmetallic Mines, 40¢. Bl 5552 Tungsten Resources of Montana Deposits of the Mount Torrey Batholith, Beaverhead County, \$1.25. RI 5579 Reconnaissance of Collifornia Manganese Deposits, 35¢. RI 56¢0 Tungsten Deposits of Cochise, Pima, and Santa Cruz Counties, Ariz., 65¢. Bl 8661 Barite Deposits of Arizona, 50¢. Bl 5679 Lake Superior Iron Resources, 30¢. IC 7023 Fusibility of Ash of U.S. Coals, \$1.75¢.

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(Continued on page 666)

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In This Issue: The following abstracts of papers in this issue are reproduced for the convenience of members who wish to maintain a reference card file and for the use of librarians and abstracting services. At the end of each abstract is given the proper permanent reference to the paper for bibliography purposes.

Need for Improvement Sparks Continued Tests at Berkeley Pit by Richard M. Stewart and Charles W. McQueen—Analyses, provided by the authors, of the operating results of the R. G. LeTourneau Co.'s electric wheel vehicle undergoing tests at the Berkeley Pit from July to Novemeber, 1960. A summary of performance attained during this test period is presented along with a comparison of diesels, diesel-electrics, and straight-electric trucks on various grades. These indicate the relative efficiencies of the trucks by comparing haul rates and cost per ton for each case considered. The truck has been modified since it first appeared at the mine; the hp has recently been doubled to 650. Ref. (MINING ENGINEERING, July 1961) p. 656.

Ref. (MINING ENGINEERING, July 1961) p. 686.

Central Washeries—Key to India's Coal Problem by G. G. Sarkar, A. K. Chakravarti, and A. Lahiri—Planning of washeries to clean Indian coals presents certain special problems. The coals, which are rather difficult to clean, are mostly obtained from a large number of small collieries and a number of seams with small individual outputs, and have wide and uncertain fluctuations in the size as well as in the washability characteristics. The present paper describes some of the basic factors which have to be considered in planning coal washeries under such difficult conditions with special reference to the designs of a number of central washeries which have been or are now being erected in India. Ref. (Mining Engireering, July 1961) p. 680.

Mining in the Arctic by Paul E. Queneau—The author provides a resume of activities around the "polar Mediterranean" that will pave the way for further exploitation of the resources in this area. Various mining operations now present are cited with examples of the activities being carried out in the area. Conclusion notes that today's military needs may lead toward tomorrow's commercial ventures in the polar climes. Ref. (Mining Engineering, July 1961) p. 694.

(Continued on page 666)

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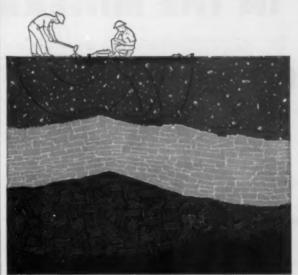
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This versatile instrument is currently available at \$750 F.O.B. Washington, D.C. For additional information contact: Dept. M.



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#### CONGO SERVICE FORMED

Formation of Belgo-American Development Corp. was announced simultaneously with disclosure that large Congo metal and farm producers had not been materially disrupted by independence disturbances. In fact it was claimed that private enterprise preserved the existence of the Congo economic entity despite the upheavals.

Auguste S. Gerard, a 30-year veteran of the Congo, delivered this evaluation at the news conference where Admiral Alan G. Kirk, former Ambassador to Moscow and Brussels, announced the formation of the Belgo-American Development Corp. of which he is president. Belgo-American, incorporated in the United States by a group of prominent Belgian Companies affiliated with the Societe Generale de Belgique, will provide businessmen and investors here with information on business prospects in the Congo and will help

NEWS

## FROM MINE AND MILL

pave the way toward increasing private U.S. participation in these activities.

Concerning the present situation in the Congo, it was noted that production levels are generally satisfactory. In 1960 copper production exceeded 300,000 metric tons for the first time. Industrial diamond production in South Kasai could set an all-time record in 1961, possibly 17 or 18 million carats if current production levels are maintained. While agricultural production has suffered

from disruptions of the transport system and from the blockade at the end of 1960 in Oriental and Kivu provinces, some companies in the Leopoldville area set production records in 1960 for palm oil, palm kernels, sugar, and cocoa.

Companies continuing to operate in the Congo have encountered numerous difficulties. They suffer from exchange controls and import restrictions, shortages of spare parts, and equipment. They also face problems in recruiting qualified personnel.



General view of the ore receiving station during the ceremony. El Teniente mine produced 250 tpd of approximately two pct copper content in 1906; today it averages 34,000 tpd. The high production figure was attributed in part to "free enterprise."

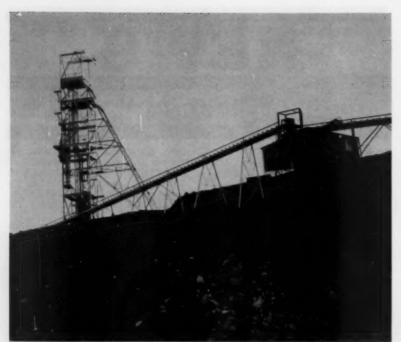
### EL TENIENTE MINE REACHES 300 MILLION TON MARK

A remarkable output of 300 million tons of copper ore, produced during the last 55 years at the historic El Teniente mine of the Braden Copper Co., was recently celebrated. Representatives of the Chilean government, labor leaders, and officials of Braden Copper participated in a brief ceremony at Punta de Rieles, entrance to the world's largest underground copper mine to observe the event that market El Teniente as the third largest copper producer in the world.

Robert Haldeman, Vice President of Braden, a subsidiary of Kennecott, stated, "We are now mining up to 35,000 tons daily, an ore total which eventually yields some 500 tons of refined copper per day. All this has been possible because of the harmony which exists between capital and labor," Haldeman added, "and because of the free enterprise system which has been allowed to develop in an atmosphere for fair incentive. We trust this atmosphere will continue to prevail, so that we may expand our activities and installations, for the benefit of the national economy, and to the advantage of our Chilean workers."

Don Carlos Pistelli, Chile's Under-Secretary of Mines, paid tribute to the "mutual understanding through 55 years which had resulted in the common good. We are convinced," he added "that the present production can and must be increased in the future, in the interests of the nation, the company, and labor."

Approximately two-thirds of the profits of El Teniente are presently going to the Chilean government, and the remaining one-third to the Kennecott Copper Corp.



The headframe, erected to a height of 168 ft, as it looked in December, 1960. Concentrate from the Christmas mine will add 36 million lbs of copper per year to Inspiration's present production in the Globe-Miami area. Production date set for early 1962.

#### STAUFFER CHEMICAL CO. LICENSES ELECTRON BEAM PROCESS

Stauffer Chemical Co. has licensed National Research Corp. of Cambridge, Mass. to operate electron beam melting and casting furnaces under a Stauffer patent covering these processes. Electron beam melting and casting has recently been commercialized after seven years of development.

Five Stauffer furnaces have been sold to date: three 25-kw units to Wah Chang Corp.; a 300-kw unit to Haynes Stellite Co., Division of Union Carbide Corp.; and a 50-kw research unit to the National Aeronautics and Space Admisintration. Electron beam processing heretofore achieved unrealized levels of purity in the production of commercial quantities of refractory metals. Substantial tonnages of columbium, and many large, sound ingots of tantalum, tungsten, molybdenum, and their alloys have been produced.

### CANADIAN FIRM ENTERS MINING EQUIPMENT FIELD

Entrance into the mining equipment field by Canadian Curtiss-Wright, Ltd., has been announced. It was revealed that the company had acquired an interest in Filton Metals, Ltd., Ontario. Canadian Curtiss-Wright is a subsidiary of Curtiss-Wright Corp. of Wood-Ridge, N. J.

Filton Metals has been formed to produce special steel products for the building and mining industries. Among the products it will manufacture is a proprietory rock bolt anchor with unique holding and recovery features. Other products to be produced by Filton include hydraulic fittings and accessories.

#### URANIUM ORE PROCESSING PLANT OPENED

The Susquehanna Corp. has completed its third uranium ore processing plant, a 250 tpd operation located near Falls City, Texas. The entire start-up procedure of the heavily instrumented and almost entirely automated plant took less than three days compared to a normal start-up time of several weeks. The company will sell the uranium ore concentrate to the Atomic Energy Commission under a \$13 million contract.

#### U.S. AND BRAZILIAN FIRMS IN JOINT VENTURE

Harnischfeger Corp. has entered into a joint venture with a Brazilian company to manufacture power cranes and shovels in Sal Paulo, Brazil. Equipamentos Industriais Villares, S.A. is operating under an agreement with the U.S. firm to use Harnischfeger's patents, designs, and manufacturing processes.

Villares also has a technical service agreement to manufacture the firm's P&H overhead electric cranes and hoists

A Harnischfeger official said that the manufacture of P&H equipment in Brazil is considered a highly significant step in the industrial and economic growth of that country.

## MCDONALD SHAFT COMPLETED AT CHRISTMAS COPPER MINE

Inspiration Copper Co. has recently completed the McDonald production shaft to the final depth of 1190 ft at the Christmas copper mine, 10 miles north of Winkelman, Ariz. Sinking of the 18 ft diam concrete shaft was begun in December 1959.

At the mine, expected to start production in the first half of 1962, copper ore will be hoisted in 12-ton capacity skips at a speed of 1320 fpm. The collar of the shaft is located at an elevation of 3000 ft.

Still under construction are the buildings for the primary and secondary crushers, the 8000-ton capacity fine ore storage building, the conveyor to the storage building, the 4000 tpd mill with two ball mills and one rod mill, the 200-ft diam tailing thickener, and the 100-ft diam regrind rougher thickener. Structures already completed include the hoist and compressor building, warehouse, changehouse, and office building.

Estimated ore reserves of the Christmas mine total 20,061,625 tons, averaging 1.83 pct copper with a recoverable copper content of approximately 660 million lbs.

Having their own facilities for building heavy machinery will help Brazil's expanding construction and public works program, according to the official.

### COMPANY EXPANSION

New York Trap Rock Corp. has entered the lightweight aggregate field. The firm expects to be serving the New York metropolitan area with a high grade structural lightweight aggregate by the spring of 1962. A \$2 million plant will be constructed on Rondout Creek in Ulster, N. Y., where a subsidiary company will produce Nytralite at an anticipated production rate of 500,000 cu yd per year. The company notes that the operation is endowed with ideal transportation facilities, offering speedy shipment via barge, rail, and truck.

## NATIONAL CONFERENCE ON INDUSTRIAL HYDRAULICS

"Versatility and Reliability of Fluid Power" will be the theme of the 1961 National Conference on Industrial Hydraulics, to be held October 19 and 20 at the Sherman Hotel in Chicago. The keynote address, concerning the responsibility for reliability as found in management of design, manufacturing, and quality control functions, will be delivered by Dr. Leslie W. Ball, director of reliability, Aero-Space Division, Boeing Airplane Co. The conference will deal mainly with the latest developments in the field of fundamental and applied industrial hydraulics.

## FIRE CAUSES TRANSFER OF PRODUCTION

Joy Manufacturing Co. will transfer manufacture of its chain products to other Joy facilities, as an interim measure pending rebuilding of the Joy Chain Plant which was completely destroyed by fire on June 2.

The plant, where chains were manufactured for mining equipment, made up approximately 12 pct of Joy's Franklin, Pa., facilities and employed 10 pct of the total Joy employment in Franklin. With transfer of production and salvage of some product inventory, the company is preparing to satisfy customer requirements for these chain products.

The plant, covered by insurance, was estimated to have received \$4 million in damages. It is speculated that the fire will have a minor effect on the company's earnings for fiscal 1961. A reconstruction of events leading up to the fire indicates that the cause was an explosion in a heat treating furnace.

### KENNEDY VAN SAUN ACQUIRED BY McNALLY PITTSBURGH

Kennedy Van Saun Mfg. and Engineering Corp. has passed controlling interest in the firm to the McNally Pittsburgh Mfg. Corp. effective May 19, 1961. McNally Pittsburg is purchasing, for an undisclosed amount, the common stock of Mr. Pyle (President of Kennedy Van Saun) and surviving members of the family of the late Joseph E. Kennedy, the firm's founder.

The cash transaction involves neither an exchange of stock nor outside financing. Upon the retirement of Mr. Pyle, Mr. Maurice Shafer, presently Executive Vice President, will become President of the firm. Mr. Edward T. McNally, President of McNally Pittsburgh, will become Chairman of the Board of the Kennedy firm. Other officers in the firm will continue in their present posts.

#### THREE COMPANIES PLEDGE MUTUAL SUPPORT

An agreement of mutual support in the engineering and marketing of automated control systems and processes has been announced by Allis-Chalmers, Consolidated Systems Corp., and International Business Machines Corp. The companies will work together when it is in the best interest of the customer to have a coordinated system. Efforts of this kind will be directed toward "a total industrial control system."

A typical integrated system will utilize Allis-Chalmer's basic industrial equipment, Consolidated Systems' special instrumentation, and IBM's data processing equipment. The agreement affords each of the participating companies the opportunity to work with others whenever appropriate.

#### RARE EARTHS CONTRACT

Michigan Chemical Corp.'s Rare Earths and Thorium Division has completed a contract with Atomics International Division of North American Aviation, Inc. for the supply of a high-density gadoliniumsamarium oxide blend to be used in the control rods of the Hallam Nuclear Power Facility, Hallam, Neb.

This is one of the first instances in which rare earth elements have been used entirely as the neutronabsorbing control rod poisons in a reactor. The rare earth material was a special blend of gadolinium oxide and samarium oxide which was prepared under very carefully controlled conditions to achieve a bulk density in excess of 5.3 grams per cu cm and a closely limited chemical analysis.

#### RESEARCH CENTER UNDER CONSTRUCTION

On May 22, 1961, National Lead Co. began construction of a new multimillion dollar research center in East Windsor Township, near Hightstown, N. J. Located on a 250 acre site adjacent to the New Jersey Turnpike, the center will comprise separate units designed to provide specialized facilities for research and development work for the company's major divisions.

Construction of the first unit of the research center is scheduled for completion in summer of 1962. The building will contain 87,000 sq ft of laboratory, office, and service space. Four wings will be devoted to research and development in the fields of non-ferrous metals, paints and pigments, lead chemicals, plastics, and resins. The present staff of 150 scientists and technicians at the company's Brooklyn research laboratories will be transferred to the new center.

## RUBBER LINING FOR COAL CHUTES

A special soft rubber lining outlasts carbon steel plates four-to-one under the impact and abrasion of heavy chunks of coal.

Sixty thousand tons of coal, pounding and grinding across %-in. carbon steel plates armoring a 21-ft coal chute at the Bayshore Station of Toledo Edison Co., cut through the plates in four to six weeks. On the same chute, %-in, soft rubber "Armorite" cushioning material lasted more than five months and carried 260,000 tons of coal before replacement. Installation of the %-in. lining has reduced chute maintenance by at least two-thirds.

Developed by B. F. Goodrich Industrial Products Co., Armorite depends on "bounce" to provide exceptional resistance to abrasion and impact. Jagged chunks of coal bounce off, rather than cut into the material, even though they hit the rubber cushioning with great force.

At right, a worker views a rubberlined chute which receives two thousand tons of coal per day on their way to the coal breaker at the Bayshore Station.





## DRAVO'S RESEARCH CENTER FOR IRON ORE PELLETIZING

A modern test facility for iron ore pelletizing research has been added to the Dravo Corp. Research Center on Neville Island near Pittsburgh. The expansion of Dravo's facilities was considered essential in view of estimates that 25,000,000 tons of pelletizing capacity will be constructed within the decade.

Laboratory test equipment used in this pelletizing facility enables researchers to perform the many tests and investigate the many variables essential to the establishment of optimum design of any agglomerating installation. In pelletizing, for example, it is necessary to determine the proper grind, moisture content, additive requirement, method of green pellet formation and firing pattern in order to establish the optimum quality, economics, and production rate attainable.

The facility incorporates, in simplified form, the following units of a traveling grate pelletizing plant: 1) A grinding mill which can be operated as a ball mill or rod mill and which can utilize either the wet or dry grinding process. 2) A filter for moisture control. 3) A charging or discharge station at which the refractory-lined steel batch vessel is filled or emptied. 4) An up-draft station where air can be blown up through the fired pellets for cooling. A small attached heater can be used to heat the air for drying green pellets. 5) A down-draft combustion chamber, used for firing or drying



First step in preparing green pellets for use in Dravo Corp's test facility for iron ore pelletizing is the grinding of ore in this mill to reduce particles to the most economical size for effective pelletizing.

pellets. Temperature ranges from room temperature to 3000°F can be maintained. 6) A heat exchanger for pre-heating combustion air. 7) An instrument panel which indicates air pressure, air flow, exhaust gas flow, suction, and firing temperature.



Incorporating all the elements of a traveling grate pelletizing plant, the facility approximates actual plant conditions for various types of agglomeration. Here green pellets are charged into a batch pot.

The temperature recorder is equipped with 12 thermocouples to allow readings at any point in the process. In addition, plans call for installation of a small auxiliary pot with a quartz window which will be used for visual check on conditions causing break-up or disintegration of pellets.

The main batch pot has a hearth area of 1.4 sq ft. However, in charging, the green pellets are shielded from beneath by a hearth layer of fired pellets, and on all four sides by a side layer. In actual plant operation, the hearth layer protects the grate bars and other machine components from the high temperatures generated in the pellet bed.

A typical charge of iron ore pellets on the research apparatus would consist of 170 lbs of green pellets, 50 lbs of hearth layer, and 50 lbs of side layer. The green pellets are prepared on a standard Dravo-Lurgi pelletizing disc or in a balling drum.

The pot, which moves back and forth on tracks, is advanced to the updraft station if drying is required, or to the down-draft station for immediate firing. At the down-shaft station, the pellets are fired by the combustion furnace which has a

capacity of 3,600,000 Btu per hour. Firing temperature is increased until the bottom of the bed reaches the maximum desired temperature which varies with the material being processed. Pre-heated air from the heat exchanger is blown through the pellets at a rate from 100 to 300 cfm, but could be increased to 600 cfm.

After firing, the pot is returned to the up-draft station where the pellets are cooled. The up-draft blower has a rate similar to that of the down-draft blower. The cooled pot is then moved back to the discharge station where material is removed by hand so that samples from different levels in the bed can be tested for characteristics. These include: comprehensive strength, size distribution, abrasion resistance, and desired chemical properties. Other tests determine such factors as porosity and specific gravity.

In handling green pellets for the firing tests, the flow of material in a full-scale plant is exactly duplicated. Green pellets are dropped from the heights with the same frequency as under operating conditions. A roller conveyor is used to feed the green pellets from the pelletizing disc to the firing apparatus.

Several series of tests to establish the correlation between results from the new facility and experience of operating plants have already been performed. From the data acquired, research engineers can scale up to full-size design requirements.



Green pellets used in Dravo Corp's new test facility for iron ore pelletizing are formed on this 39-in. pelletizing disc. Dravo Corp. is an American licensee of the Lurgi Co., Frankfurt, Germany.

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JULY 1961 MINING ENGINEERING—662

## THE CALUMET DIVISION\* STORY METALWORKING. AGRICULTURE, MINING



\*DIVISION OF CALUMET & HECLA, INC.



1. One of the many Calumet Division mines from which copper is taken from the surth.



2. Miners many, many feet under the ground, drilling prior to blasting loose chunks of copper ore.



3. The ball mill installation of Calumet grinding the one before refining, Calumet manufactures hi-Hard I grinding halls and mill liners for its own use and for sale.



4. Copper billets before shipment. Most billets are sold to the sister division—wolverine Tube.



5. Copper scrap is reclaimed in giant leaching tanks like this huge battery.



6. Brown copper oxide is marketed for agriculture; a fertilizer grade, a nutritional and fungicidal apray, and a trace mineral feed supplement for animals.



7. Columet Ni-Hard grinding bails are eventable from stock in the following sizes: 16°, 16°, 16°, 17', 116°, 116°, and 2°.



28. The Calumet foundry also produces giant or Ni-Hard mill liners are an important product—n Calumet operations, but for the entire mining in



9. The Calumet machine and plate shop works not only as a captive plant, but also does custom work for general laduates.



10. The uranium mine in New Mexico—another Calumet Division activity.

†Reg. U.S. Pat. Off., Intl. Nickel Co., Inc.

Write for more information of the following numbers on the following numbers of the following nu



## CALUMET DIVISION

Calumet & Hecla, Inc.

23 CALUMET AVENUE . CALUMET, MICHIGAN

# ideas and news:





Latest step in mill trunnion drive evolution: New TWINDUCER drive divides mill load electrically between twin synchronous motors. Compared to trunnion drives with mechanically divided load, the TWINDUCER drive requires 50% less space. Since there are no floating gears or pinions, gear wear is kept to a minimum. TWINDUCER drive fits any plans for automatic grinding operation.

World's largest crusher to be duplicated: Because it has achieved very favorable results in expanding production and lowering operating costs, this giant Allis-Chalmers crusher will soon have a running mate. Scheduled for installation at the same ore reduction plant is an identical 60-109 SUPERIOR crusher with HYDROSET mechanism. Allis-Chalmers will also furnish two 500-hp motors, four 30-70 SUPERIOR secondary crushers, and four 300-hp motors for the installation. Drive motors and crushers are designed together . . . built together at A-C.

## Which of these productive ideas could be working for you?

Larger, more efficient crushers and screens. Easily maintained switchgear. Reliable substations. These examples demonstrate the extra value that is standard with A-C...the greater efficiency and the added productivity which are yours when you buy A-C products, systems and services. Call your Allis-Chalmers representative for details on A-C "worth-more" features. Or write Allis-Chalmers, Industries Group, Milwaukee 1, Wisconsin.

A-1481

For further information, circle the following numbers on the reader service card 21—Twinducer; 22—Superior; 23—Hydroset; 24—Low-Head; 25—Switchgeor 26—Substation.



Low-Head screen with direct mounted motor — A completely integrated screening unit is this new, LOW-HEAD horizontal screen with direct mounted motor. No supporting structure, no belt tensioning or alignment problems plus headroom saving, smooth starts and stops, easy accessibility for maintenance. Another example of engineered screening from Allis-Chalmers.

Lowest height, easiest access 5-kv metal-clad switchgear on the market. Just 72 inches high. You get eye-level instrumentation, shoulder-height accessibility of component parts. Other outstanding advantages: front-accessible current transformers; maximum compartmentation and dead-front construction for greater safety; full-panel metering; rapid, one-stroke breaker insertion. Choice of stored energy or solenoid operation.





Reliable performance that's one mile high: This A-C substation has completed about five years' service 6546 feet up the remote Wasatch mountains of eastern Utah. Equipment survived rugged transportation up the mountain side on steel skids or trucks over rough bulldozed road. One switchgear fell from truck but was not damaged beyond a few dents. Picked to give dependable performance in this inaccessible, practically unserviceable location, A-C substation has proved out well beyond expected performance.

ALLIS-CHALMERS PRODUCTS: Look to Allis-Chalmers for compressors, controls, crushers, earth-moving equipment, electrical distribution equipment, engines, generators, industrial systems, kilns, lift trucks, mills, motors, pumps, rectifiers, screens; thermal, hydro and atomic electrical generating equipment; tractors, transformers, unit substations.

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Vulcan IRON WORKS CO.

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- · REPLACEABLE Segme Cat. No. 117

#### VULCAN MINE SHEAVES

- Cast Steel or Mechanite
- Flame Hardened Groove or Replaceable Liners Cat. No. 117



#### VULCAN MINE HOISTS

or Divided Drun Cat. No. AC 6002

## **VULCAN AUTOMATIC OR PUSH** BUTTON OPERATED HOISTS

ow economical for production in small ines, or man service in large mines.

Catalog No. AC 6002



#### VULCAN SKIPS & CAGES

- or Vertical Skips
- Cat. No. DA 6010



#### VULCAN SLUSHER HOISTS

or Special Design Single, Double or Cat. No. DB 5709



## VULCAN CHAIN SAWS

Cat. No. JB 5805



ALIMAK RAISE CLIMBER SAFER CHEAPER

EASIER

Write For Literature

## CASTINGS, MACHINING, **CUSTOM FABRICATIONS**

Special Designs of All Equipment



(Continued from page 652)

RI 5584 Use of High-Speed Camera in Blast-ing Studies. RI 5585 Effects of Temperature Variations on Contact Angles for Coal and Related Sub-

stances.
RI 5593 Flotation Characteristics of Goethite.
RI 5594 Gasification of Bone Anthracite.
RI 5597 Studies of Several Floculants to
Improve Hydraulic Backfill Characteristics.
RI 5598 Flotation of Low-Grade Mercury

Ores 5599 Technology of Bastnasite.

RI 5599 Technology of Bastnasite.

RI 5695 Simulated Underground Gasification of Coal and Electrolinking-Carbonization Method of Preparing Path in a Coalbed.

RI 5699 Freparation Characteristics of Coal From Butler County, Pa.

RI 5612 Tungsten Resources of Montana: Deposits of the Philipsburg Batholith, Granite and Deer Lodge Counties.

RI 5613 Hazards of Cutoff Explosive Charges in Multiple Blasting of Coal.

RI 5612 Tue of Sonic Techniques in Exploring Coal-Mine Roof Strata: A Progress Report.

ort. BI 5626 Field Test for Beryllium Minerals: The Morin Fluorescence Method. BI 5624 Laboratory Equipment and Test Procedures for Evaluating Explosibility of

Dusts.

Bi 5629 Acid Leaching of Oxidized Copper Ores By Downward Percolation.

Bi 5631 Extracting Final Stump in Pillars and Pillar Lifts With Continuous Miners.

Bi 5632 Controlling Mine Fires With High-Expansion Foam.

RI 5638 Production Nickel-Bearing Iron From Cuban Ores in a Batch Rotary Kin.

Bi 5634 Laboratory Treatment of California and Nevada Manganese Ores by Sulfation-Reduction and Other Methods.

Bi 5646 Flotation of Pacific Northwest Chromite Ores.

mite Ores. RI 5652 Refractory-Clay Deposits of Wyoming. BI 5657 Rapid Evaluation of Spodumene and Kyanite Samples by Heavy Liquid Separa-

Kyanite Samples by Heavy Liquid Separation.

RI 5806 Underground Gasification of Coal:
Hydraulic Fracturing as Method of Preparing a Coalbed.
RI 5807 Effect of Isomorphic Substitutions on Properties of Fluormica Ceramics.
RI 5872 Ceramic Fibers for Filtering Dust From Hot Gases.
RI 5873 Hydrogenating Coal in a Pilot Plant With a Molybdenum Catalyst.
RI 5874 Producing Heavy Fuel Oil by Hydrogenating Bitumious Coal.
RI 5879 Cebolia Creek Titaniferous Iron Deposits, Gunnison County, Colo.
RI 5883 Reducing the Incendivity of Permissible Explosives by Sodium Chloride.
RI 5885 Acid Curing and Countercurrent Decantation Washing of an Oxidized Copper Ore From Pinal County, Ariz.
RI 5891 Selectivities of Laboratory Flotation and Flost-Sink Separation of Coal.
RI 5893 Fersmite: A Rare Calcium-Colum-

Rejects.

BI 5003 Fersmite: A Rare Calcium-Columbate Mineral From Montana.
BI 5004 Shallow Lead Diggings, Grant and Latayette Counties, Wis.
BI 5005 International System for Classifying Brown Coals and Lignites and Its Application to American Coals.
BI 5005 Fine-Screening of Coal: Testing of the Sieve Rand.

the Sieve Bend. RI 5795 Extracting Tar Acids With Mono-RI 5797 Research on the Hazards Associated With the Production and Handling of Liquid

Hydrogen. RI 5708 Design Criteria for Portable Seismo-

Ri 5768 Design Criteria for Portable Seismographs.
RI 5713 Effects of Hydraulic Fracturing in Oklahoma Waterflood Wells.
RI 5714 Reconnaissance of Titanium Resources, Kemper County, Miss.
RI 5715 Susceptibility of Organic Compounds to Tritium Exchange Labeling.
RI 5719 Development and Operation of a Pilot Plant for Feeding Bituminous Coal Slurry to a Pressure Gasifier.
RI 5721 Preparation Characteristics of Coal from Preston County, W. Va.
RI 5724 Smelting Taconite in the Bureau of Mines Experimental Blast Furnace.
RI 5725 Ultimate Composition of Organic Material in Green River Oil Shale.

For further information, circle the following numbers on the reader service card (p. 661): 27—Cat. No. 117; 28—Cat. No. AC 6002; 29—Cat. No. DA 6010; 30—Cat. No. DB 5709; 31—Cet. No. DB 5805; 32—Allmek Raise Climber.

RI 5726 Laboratory-Scale Casting Furnace for High-Melting-Point Metals. RI 5727 Rapid Determination of Aluminum, Iron, Copper, Cadmium, and Lead in Zinc-Base Alloys. RI 5729 Beneficiating Spodumene from Peg-matites of Gaston County, N. C. RI 5731 Carbonizing Properties of Wyoming Comis.

Conis.
RI 5732 Performance of Dense-Medium Cy-cione in Cleaning Fine Coal.
RI 5749 Recovering Cobalt and Nickel from Complex Sulfide Ores of Southeastern Mis-

souri.

BH 5741 Using A Centrifuge for Float-and-Sink Testing Fine Coal.

BI 5743 Determining Phosphorus in Coal and Coke: Evaluation of Volumetric, Colorime-tric, and Gravimetric Methods.



(Continued from page 653)

Concreting Remains the Answer for Ground Support at the Kelley by R. P. Corbett—The Kelley Mine has been the site of extensive concreting underground commencing in 1953. The author discusses the early practices of replacing such ground support and emphasizes today's present practice. Ref. (MINING EMGINERRING, July 1961) p. 700.

Ficialism & Regineering, July 1961) p. 706.
Ficialism of Spodumene-Beryl Ores by James S. Brouning—The U.S. Bureau of Mines has been experimenting with flotation processes to separate the spodumene-beryl ores mined at Kings Mountain, N. C. The author discusses their success to date and the process as it presently stands. Further experimentation is underway. Studies will be made on the milling costs involved in the flotation process. Ref. (Mining Engineering, July 1961) p. 706.

p. 706.
Conflicting Interests in the Exploitation of Industrial Minerals—A symposium of articles pertaining to the vital problem confronting the nonmetallic industry. The spread of urbanization, the withdrawal of public lands, and the construction of reservoirs have resulted in the loss of large areas that might have potential value as mineral sources for our economy. The authors recognize the needs of other groups but look at the problem from the viewpoint of our industry. Bef. (MINING ENGINEERING, July 1961) p. 708.

## BUYERS' BLOCK

FOR SALE OR LEASE—600 choice, select patented mining claims in the precious metal mining district of Silverton, Colorado, Metallurgists say there is enough manganese (rhodonite) to pay mining and milling expense of a 3000 ten per day mill operation. Lease only to competent mining corporations. Sale et cost of patent and taxes already paid.

Merrill Ross, Box 1835, Durham, N. C.

#### DRILL STEEL

Swedish semi-alloy hollow drill steel: \$15.00 Swedish carbon hollow drill steel: 7/4" Q.O. 11/4" Round 11/4" Round American and Canadian chrome molybdenu alloy hollow drill steel: 7/8" Q.O. \$15.00 1" Q.O. \$20.00

Above steel is all new, in as-rolled condition, in mill lengths of about 20 ft. Prices are U.S. Dollars per 100 lbs., c.i.f. Western Hemisphere Ports. Write:

Box 61-7ME5 MINING ENGINEERING 29 W. 39 St., New York 18, N. Y.

# PRODUCT

## FOR MINE AND MILL

Conveyor Feeder Model NF-6-168 pneumatic conveyor feeder has been announced by Na-tional Air Vibrator Co. The feeder is about 161/2 ft long, and has a 4x24-in. trough that can move bulk, granular material or assembly parts at capacities up to 30 tph. The flow rate can be altered by adjusting the air pressure range from 20 to 70 psi. The machine is operated by a Navco BH4 air vibrator that incorporates a one-piece design and has a silent vibrator piston as the only moving part. Since the new feeder uses no bearings or electrical control adapters, it is reportedly almost maintenance free and requires no costly stock of spare parts. Circle No. 76.

**Bin Outlet** 

A device to provide full and uniform flow of granular and lump bulk materials from bins, hoppers, and silos has been developed by The Bin-Dicator Co. A hyperbolic outlet, it reportedly eliminates bridging, ratholing, and erratic flow of granular or lumpy material and is particularly effective in handling such materials as wet coal, rubber pellets, shale, and stone that tend to pack and bridge in conventional outlets. This outlet replaces the lower section of a conventional hopper and becomes an integral part of the bin. It eliminates the need for vibrators and other attachments presently used to increase flow of bulk materials. Circle No. 77.

**Heavy-Duty Truck** 

KW-Dart Truck Co. has announced production of Model 32S, constructed of hi-tensile strength steel. The truck will deliver 32 tons of payload on a maneuverable short wheel base. Tires are 24 ply, 18.00 x 25; engine is a Cummins V8-350, a 350 hp deisel. Unit-mounted, heavy-duty trans-mission provides 10 speeds forward, two reverse; a torque converter is optional. Circle No. 78.



**Dragline-Clamshell** 

A Model 210-B diesel-electric dragline and clamshell has been introduced by the Bucyrus-Erie Co. The machine, with boom lengths of 100, 120, and 140 ft, can handle buckets of up to 10-cu yd capacity. The 210-B reportedly eliminates friction clutches for all cyclic functions. Hoist and drag, or holding and closing motions are regulated by a static type control of independent electric eddy current clutches which are liquid-cooled by a radiator system. Positive lubrication of gears and



bearings is provided by oil pumps, thus assuring adequate lubrication at all times. Unitized construction assures correct lineup of shafts and bearings. Three sets of crawlers are available: standard, intermediate, and long-wide for soft ground conditions. Circle No. 79.

#### Shut-Off Valve

Robbins Aviation, Inc. has developed a husky miniature shut-off valve with positive bonnet lock. The valve (SSG106-2L), designed for maximum safety, is intended for use with oxygen, nitrogen, helium, air, fuels, hydraulic oils, and chemicals. Typical applications include gas sampling cylinders, pressure gauges, high pressure instrument sampling lines, butane tanks, trailer lines, etc. Operating temperature is from -65°F to +250°F, for high-vacuum to 3500 psi service, with shut-off torque of only 6 in.-lbs at 2000 psi. Dimensions of the valve are % in. by 1% in., and approximately 2 in. height in open position; two 4-in. pipe ports are provided. Circle No. 80.

**Cutter Bit** 

The U21 cutter bit with dual gage shoulder design and rigid dimensional control has been announced by Kennamental Inc.'s Mining Tool Division. Dual gage shoulders on the bit provide front and rear bearing areas that can absorb severe shock forces. A pull-out notch, which replaces the pull-out shoulder of previous bit designs, reportedly permits easier, quicker, and safer extraction of tools from blocks on ripper-type chains. Close dimensional tolerances permit close fit which assures bit stability in the block and positive cutting action. These tight fitting bits also minimize deformation of tool holders, lessen flexing, and lengthen the life of rubber keepers. Three styles are available: full nose radius, recessed or channel style, and cylindrical plug style. Circle No. 81.

Auger-Drill

General Metals Corp.'s Power Tools Division has released its No. 26100 portable auger-drill. This convertible self-contained power tool can auger or drill in soil, gravel, steel, masonry, wood, concrete etc. A special 2½-hp, two-cycle engine with recoil starter and diaphragm carburetor makes the unit operable in either vertical or angle position. Maximum torque and adequate rpm permit a single operator to drill or auger holes from 1% to 9 in. Replaceable cutting lips made of rock drilling martempered alloy steel add to the flexibility of the machine. Circle No. 82.

**Tractor-Scraper** 

A new power-shifted tractor-scraper (619C) with a maximum of 280 hp has been announced by Caterpillar Tractor Co. Major features include 18 cu yd heaped capacity, turbocharged engine, 30 mph road speed, air-actuated cable control, and unitized construction. An exclusive torque divider power shift transmission provides nine speeds with only three operator shifts. As load resistance is overcome, the transmission automatically shifts within each speed range from torque divider drive to direct drive to overdrive. Downshifting is also automatic. To develop maximum rimpull at pusher matching speeds for fast loading, the unit can be locked in torque divider drive. A six speed direct drive is also available. Circle No. 83.



Diesel Mining Tractor
The Frank G. Hough Co. has announced a low-profile, pneumatic-tired tractor with a 6000 or 8000-lb drawbar pull for underground mining haulage. Overall dimensions of the TD-80m are about 12 ft long, 5½ ft wide, and 3 ft high. The power train features a 6-cylinder, flat diesel engine, torque-converter and automatic transmission with 3 forward and 1 reverse ratios. This vehicle,



with a 24-v electrical system, has both air starting system and exhaustscrubber as standard equipment. Circle No. 84.

**High Voltage Relay** 

The HV series high voltage relay has been made available from distributors' stock of Elgin National Watch Co.'s Electronics Division. This lightweight, continuous-duty relay is designed for making and breaking high voltage circuits of low current carrying capacities. Contacts will break up to 5000 volts rms at 200 milliamps current. Circle No. 85.

A lightweight (36 lbs), high lifting capacity (15 tons), aluminum track jack designed for high or low operations has been developed by Duff-Norton Co. From its broad 61/2 x 101/4-in. base, it measures 14 in. high and has a raise of 71/2 in. Foot lift height is 2 in. and rack size is 1% in. square. The model 717-BA has a special aluminum alloy housing, high carbon, heat-treated steel socket lever, and heat-treated alloy steel pawls and support bushings. Support bushings are grease packed for maximum efficiency. Circle No. 86.

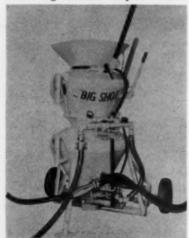


Instrument Panel Cover

A molded fiberglass instrument panel cover has been manufactured by Caterpillar Tractor Co. for their D8H and D9G tractors. The cover protects against vandalism while the machine is parked or unattended. It is attached by two tongs that fit into slots along the top front edge of the dash and is padlocked at the bottom through an angle fitting welded to the underside of the dash. While the tractor is in operation the cover is stored beside the operator's seat. Circle No. 87.

Concrete Emplacement Gun

A concrete gun, The Big Shot, has been designed and is now being marketed by Air Placement Equipment Co. The machine maintains a high level of production due to the following features: faster cycling with a 15-in. spherical slide valve; larger, 5-cu ft hopper capacity; and positive feed control. An automatic in-line fog oiler and simplified valve

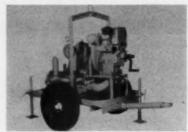


action result in smoother operation with minimum maintenance. The large manhole doors to both upper and lower chambers reduce clean-up time to minutes. Production rates range from 5 cu yd (6.8 tph) to 14 cu yd (19 tph). The capacity to handle 34-in. material is made possible by a factory modification of the feed wheel. Powered by a 4-hp rotary vane air motor and heavy duty gear box drive, the gun maintains its production rate with the coarsest materials. Circle No. 88.

Self-Sharpening End Bits

Self-sharpening end bits of forged steel have been made available for No. 7A and No. 7S bulldozers by Caterpillar Tractor Co. These optional attachments have improved penetration and are recommended for heavy duty applications. The leading edge and extended tip of the bits are shaped to be self-sharpening as wear occurs, thus retaining optimum penetrating angle throughout the life of the end bit. Outer portions of the bits are hardened. Circle No.

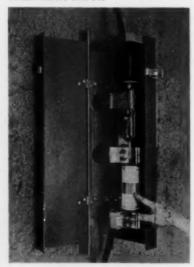
Diaphragm Pumps A series of four air-cooled, dieselpowered, self-priming diaphragm pumps has been announced by Rice Pump & Machine Co. This line includes both single and double diaphragm pumps. The pumps are available with 2, 3, and 4-in. openings. Swing type valves are offered as



standard equipment, with ball valves optional at additional cost. Capacities range from approximately 1500 to 18,000 gph. Controlled weights throughout the overall design permit the use of high speed trailers with 4.00 x 12 and 5.90 x 15 pneumatic tired wheels and tow tongues. Skids and conventional wheel mountings are available. Circle No. 90.

**Fuse Box For Mining** 

Low cost 600-amp fuse protection is offered in a fused power box announced by Ohio Brass Co. This unit is offered in two types: one is designed for carrying from job to job while the other is intended for wall mounting and has a built-in switch for cutting the circuit during fuse changes (the portable unit accomplishes this by being detached from the power source during fuse-change). Designed for heavy-duty mining applications this product reportedly gives the lowest cost protection for circuits of 600 amp capacity. Since both types of the fuse box are alike in construction, many parts are interchangeable. To keep costs low, the fuse box has been designed to use cartridge fuses with renewable links. Circle No. 91.



# **AGELESS AKINS**

1934 Akins Simplex Classifier still giving Dependable Performance for Virginia-Carolina Chemical Corp.

The 78" Akins Simplex Classifier,
built in 1934, is dewatering
coarse feed in a special flotation
circuit. The new 72" Akins
Duplex Classifier, with flared tank
and serrated shoes, is
dewatering and desliming
flotation feed. Photo shows three
of more than 200
Massco-Grigsby Pinch Valves
purchased by Virginia-Carolina
Chemical Corporation.



## **Working Beside New Akins Duplex**

The 78" Akins Simplex Classifier, built in 1934 for a large mining company, was acquired by Virginia-Carolina Chemical Corporation in 1956. Based on its dependable and efficient operation the company purchased a 72" Akins Duplex Classifier and a 60" Akins Simplex Classifier for its Clear Springs phosphate plant in Florida. These classifiers were sold and serviced by Mine and Smelter's Sales Agent, R. H. Clark Equipment Co., Inc., Mulberry, Florida.

"Ageless" Akins Classifiers, for washing, desliming, dewatering, size separation, and closed-circuit grinding, are available in sizes from 12" to 84" spiral diameter, simplex and duplex, with standard or submerged spiral. Sand raking capacities up to 7860 tons per 24 hours; overflow capacities up to 2386 tons per 24 hours.

For complete information write for Catalog No. 601

The Company that cares enough to give you the best! Manufacturing Division

MINE AND SMELTER SUPPLY CO.

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Licensed Manufacturers and Sales Agents in Conada, Australia, Sweden, England, South Africa Sales Agents in Mexica, Pero, Chile, Philippine Islands, Japan, New York City (for Continental Europe) and in prior pall rities at the United States.

# DATA FOR MINE AND MILL

(101) ROTARY FEEDERS: A sixpage bulletin describing model STT rotary feeders for feeding bulk materials, chemicals, catalysts, and slurries under high differential pressures, is available from Beaumont Birch Co. These feeders are said to be the only models with adjustable periphery seals and with adjustable periphery seals and with adjustable and renewable tips on the rotor blades that permit working pressures up to 25 psi. Illustrations and diagrams show how every part of the feeder subject to wear can be adjusted from the outside without removing the feeder from the line.

(102) COAL BLENDING: B-I-F Industries has issued "It's A Fact" data on the problem of blending high and low volatile coals to prevent excessive expansion in coke ovens. This data, accompanied by pertinent bulletins, describes the accurate and economical solution of blending by weight, and features the company's Conveyoflo Series 550. Also included are schematic diagrams of a typical installation, dimensions, and a thorough description of the operation, and uses of B-I-F equipment for the blending of coal or other similar applications.

(103) ROLLER AND IDLER REBUILDER: Data on a completely automatic machine designed for crane or shovel rollers, idlers and wheels, are contained in a bulletin issued by Automatic Welding Co. The dual head Micro-Matic will accept rollers, idlers, and wheels up to 40 in. in diam. The bulletin includes photographs and descriptions of the construction and operational features of the machine.

(104) PROTECTIVE CLOTHING: A yellow nylon neoprene work suit, weighing only about 2% lbs and reportedly four times stronger than other suits of its kind, is featured in a data sheet released by B. F. Goodrich Industrial Products Co.

(105) MOTION SAFETY SWITCH: An improved motion safety switch for protecting machines, equipment, and processes against damage from stoppage or reduced speed is described and illustrated in a fourpage bulletin offered by Fuller Co. Design, installation, and operation of the switch are described, as well as typical applications. Two installation photographs and a cutaway drawing of the switch are included.

(106) DRILL RIGS: Catalog No. 615. available from Mobile Drilling, Inc., covers a complete line of hydraulic drill rigs, tools, and accessories. The 80-page catalog gives detailed descriptions, including specifications, on over 1900 items related to rotary drilling and soils exploration. An exclusive feature of the catalog is the water-air selector table which permits drill operators to readily determine the correct gpm of drilling fluid or cfm of air required for rotary sampling and coring. Another feature is a revised preface to the sample tool section which explains the techniques of modern subsurface exploration.

(107) ROLL SHELL: Columbia Steel Co. has published bulietin 1071 giving details about the 40x22-in. "Pioneer Smooth" roll shell. The bulletin gives extensive information including the drawing number, weight, dimensions, and metallurgical data.

(108) COAL HANDLING: A geometric theorem for coal handling is proposed in an eight-page booklet released by Caterpillar Tractor Co. The theorem—the shortest distance between a stockpile and a hopper is a Cat coal handler. Entitled, "Geometry of Coal Handling," the booklet poses a number of coal handling problems and uses actual job studies to suggest solutions for them. Two examples are given of power companies requiring short distance haul to reclaim coal from storage. Several other examples are given.

(109) PRECISION SWITCHES: A 20-page catalog covering a representative selection of products from a complete line of precision switches for industrial, commercial, data processing, and electronic applications, has been announced by Micro Switch, a division of Minneapolis-Honeywell Regulator Co. Catalog 104 has photos and condensed descriptions of over 200 items, including miniature switches, special purpose switches, electronic switch-circuit assemblies.

(110) SINGLE-ROLL CRUSHER: A six-page bulletin describing the Super Black diamond crusher, a single-roll unit designed to crush gypsum, phosphate, rock, shale, slate, mine refuse, and ores has been issued by McLanahan Corp. Detailed in bulletin SBD-95 are construction data, sizes, crushing capacities, and dimension drawing.

(111) VIBRATING SCREEN: A twin shaft vibrating screen, announced recently by Koehring Co. of California, is featured in a bulletin released by the company. The brochure presents a graphic story of how the double shafts produce a more uniform pulsation over the entire length of the screen, preventing "gallop" and providing higher capacity than single shaft screens. The unit is available in three sizes: 4x8 ft, 4½x10 ft, and 5x14 ft. Other features illustrated and described in the brochure include bolted screen cloth to eliminate welding tensions, removable lower deck to permit use as a single deck screen, and adjustable bearing cartridges without need of disassembly.

(112) DUST SEPARATOR: The HV centrifugal dust separator is detailed in a new bulletin released by The Day Co. This 12-page illustrated booklet (E-221) includes performance data, selection and dimension charts, and installation photos with descriptions of the cyclonic separator and supports. The HV is a high efficiency unit which comes in 20 standard sizes and can handle any volume of air from 150 cfm efficiently and economically. The unit handles fibrous, granular, abrasive, and fine or coarse dusts and can be used on pressure or vacuum.

(113) GRINDING MILL CONTROL: Hardinge Company, Inc. has issued bulletin AH-480-31 which describes a grinding mill control with continuous recorder. The reported functions of this unit are: signals operator in the event of incorrect adjustments, records operating and down time, informs operator when bin runs empty or bridges, and indicates when mill conditions are abnormal.

(114) VIBRATORY FEEDERS: A four-page bulletin No. 308 on pneumatic vibratory feeders has been released by National Air Vibrator Co. The feeders feature a one-piece vibrator which eliminates body assembly bolts and reduces maintenance.

(Continued on page 672)

For more information about the Joint Meeting of the Industrial Minerals Divisions of CIM and SME being held in Ottawa, Ontario on October 1 to 3, fill in your name and address on Reader Service Card and circle No. 100.

# It's NAYLOR.



## . . the Pipe and Coupling Combination for Savings!

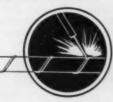
You can't match the combination of NAYLOR Spiralweld pipe and Wedgelock couplings for saving time, work and money on pipe lines in mining service.

Your savings start with the light weight of the pipe, but there's no sacrifice of strength, thanks to the exclusive lockseamed-spiralwelded structure. Handling is simplified, installation is faster and easier, especially when you use NAYLOR Wedgelock couplings to speed connections.

For air, water, and tailings service, get the details on this NAYLOR time-and-moneysaving combination. Ask for Bulletin No. 59.



NAYLOR Wedgelock couplings make a positive connection securely anchored in standard weight grooved ends. A hammer is the only tool required to connect or disconnect the coupling.



## NAYLOR PIPE Company

1256 East 92nd Street, Chicago 19, Illinois
Eastern U. S. and Foreign Sales Office: 60 East 42nd Street, New York 17, N. Y.

(Continued from page 670)

(115) BUCKET ELEVATOR SYS-TEMS: An 84-page manual (be-55), announced by Webster Manufacturing, Inc., is designed to simplify the selection and application of bucket elevator systems for bulk handling of coal. Fundamentals to be considered in selecting the right bucket elevator for a given handling problem are listed as: type of material to be handled; weight per cu ft; handling rate: maximum lump size; height material is to be elevated; duty per day; chemical reaction of material; and protection required from weather, heat, dust, etc. A table lists 101 different bulk materials regularly handled in various industries and 318 possible bucket elevator types from which can be selected the right types for specific situations.

(116) ROTARY VIBRATOR: A fourpage bulletin, RV-32061, outlining its line of electromechanical rotary vibrators has been made available by Syntron Company. Complete data and specifications are included in addition to a number of illustrations showing various applications. The vibrators are totally enclosed, dust-tight, water-tight, and are lubricated through accessible fittings.

(117) TEACTOR EQUIPMENT: Features and specifications of its crawler and wheel utility tractor equipment have been made available by Allis-Chalmers. The illustrated folder contains photos of each model utility tractor with the attachments engineered to it.

(118) THERMAL DRYER: McNally Pittsburg Mfg. Corp. has issued bulletin No. 361 which supplies information on its thermal dryer, the Flowdryer. The brochure gives description, photographs, and dimensional drawings of the machine.

(119) PERCUSSION BITS. A complete line of carbide tipped bits for all types of rock drilling, quarrying, and open pit mining is covered in catalog VR-500 issued by Vascoloy-Ramet Corp. The bits are designed to eliminate stresses that commonly cause bit failure. Charts contain data on each bit to help in selecting the suitable bit for your equipment. The complete line includes bottoming and shoulder bits in all popular threads, down-the-hole bits for splined or API thread connections, and push-on style bits; all are available in a wide range of diameters.

(120) ACIDITY ANALYSIS: A twopage data sheet, offered by Technicon Controls, Inc., outlines a continuous, automatic method for determination of total acidity. The method details a means by which, with the addition of a suitable buffer, slight changes in acid concentration will give only slight changes in indicator color, instead of the usual sharp, complete change. A flow diagram of the system is included. (121) TESTING SIEVES: Bulletin F-S-61, issued by the Newark Wire Cloth Co., contains complete technical data on all types of testing sieves including 1961 ASTM, NBSM and ASA sieve standards. The bulletin also gives information on the "End Shak" testing sieve shaker machine.

(122) CONVEYOR MAINTENANCE: Conveyor belt operation in the mining field is the subject of booklet MB 1-1956 offered by Hewitt-Robins. In ready reference form, material in the booklet describes some of the common belt maintenance problems, their causes, and methods of correcting them. The booklet covers erection of conveyor belts, training the belt, tension, lagging, loading points, fire hazards, inspection and examination, storage, and splicing. The dual backsight coincidence method of longitudinal alignment of conveyor belts is also outlined.

(123) STEEL PULLEYS: A brochure describing the one-piece "Curve Crown" pulleys featuring exclusive spun end construction recently developed by Stephens-Adamson Mfg. Co., is now available. All end plate weldments have been eliminated in this type of pulley. Thus, principal sources of metal fatigue, stress, and other trouble have been eliminated. Other sections of bulletin 1160 include a description of the "Squeeze Lock" hub and a rating chart, dimensions, and weights of the pulleys.

(124) METAL CLEANING AND PROCESSING: Turco Products, Inc. has released a 12-page metal-finishing brochure titled "Specialized Chemical Processing Compounds for the Metalworking Industry." This illustrated booklet contains specific information for the use of each of the 43 products in the company's standard line of cleaning and processing compounds for the metalworking industry. Among the chemical processes discussed in the brochure are: cleaning, phosphating, conversion coatings, protective coatings, paint and carbon removing, descaling, rust removing and prevention, processing aluminum, and maintaining paint department and other plant

(125) STEEL BELT CONVEYORS: Sandvik Steel, Inc. offers an eightpage booklet containing 36 line drawings and seven photos illustrating applications and features of steel belt conveyors. Entitled "For All-Round Use," the booklet illustrates such applications as live-storing of backlogged metal parts, handling different materials on the same band, drying damp materials by blowing hot air through band perforations. and cutting materials directly on the band. Also covered are such steel belt features as: ease of cleaning and the resistance to both high and low temperatures.

(126) CRUSHERS: Features of 22-and 30-in. Hydrocone crushers with Hydroset control are described in a bulletin released by Allis-Chalmers. Designed with a complete range of chambers for coarse, intermediate or fine crushing, the units are available with feed openings to 5 in. and capacities to 68 tph. The bulletin has cutaway diagrams of the crusher and its instant hydraulic adjustment, dimensions, together with approximate capacities.

(127) MOVABLE JAW CRUSHER: The Columbia Steel Casting Co, has released a folder giving detailed information about the 18 x 36-in. Cedar Rapids twin movable jaw made from manganese steel. The bulletin includes such data as weight, tooth depth, and overall thickness of the announced item.

(128) CRANE-EXCAVATORS: A bulletin featuring the 605 crane-excavator has been released by Koehring Division of Koehring Co. The bulletin describes the machine, rated as a 1½-yd shovel and 36-ton crane. Design and construction advantages are described: self-cleaning crawlers, adjustable tapered hook rollers, one-piece fabricated turntable, spring set, and tapered hoist lagging.

(129) PRESSURE-TREATED TIMBER: "Wolmanized Pressure-Treated Mine Ties, Timbers and Lumber" is an illustrated eight-page brochure issued by Koppers Co., Inc. concerning wood protected against deterioration from rot-producing fungi. Used for above and below ground applications, the timber provides safer, less hazardous mine operation, reduced maintenance and operating costs.

SULFUR MINING: Texas Gulf Sulphur Co. has just prepared a revised edition of their informative "Modern Sulphur Mining" which was last published several years ago. This edition updates statistical data and latest developments in both production and distribution of this essential commodity. Write directly to the Sales Department, Texas Gulf Sulphur Co., 75 E. 45 St., New York for a copy.

#### **New Films**

The International Nickel Co. is offering three 16mm, sound and color films dealing with the refining of ores from the Sudbury Basin. The titles of the films are, "Refining Nickel From the Sudbury Ores," "Refining Copper From the Sudbury Ores," and "Refining Precious Metals From the Sudbury Nickel Ores." These highly rated films demonstrate in detail the methods and processes employed by Inco in refining the various ores from the Sudbury Basin. Running time of the films ranges from 29 min to 52 min. To obtain a loan of any one or all of these films, write to: Rothaker Inc., Time & Life Building, New York 20, N. Y.



## Specify Anaconda all Butyl Shovel Cable

This new shovel cable—the toughest in the industry—cuts shovel downtime. Months of torture testing throughout the country have proved it.

It endured the rugged cold of the Mesabi and the punishing heat of Florida's phosphate mines.

It was twisted, kinked, soaked, crushed and run over.

Its new Butyl jacket is the reason for this extra durability in the face of the effects of ozone and moisture and extreme physical punishment.

It is especially compounded to combine flexibility at low temperatures with thermal stability at high temperatures. Here are other construction features which contribute to

this cable's unequalled service record:

 Anaconda's rubber-core grounding conductors offer a cushioning effect which minimizes pinching and wire breaking and offers greater ground contact protection.  Special shielding—a combination of copper cross-braided with cotton—eliminates chafing (and makes splicing faster and easier too).

 Insulation is a special high-grade Butyl that withstands ozone, heat, and moisture.

Check all the features of this job-proved new shovel cable—they add up to extra cable life, less downtime, and dollar savings. Contact Department EFL-1-PQ, Anaconda Wire and Cable Company, 25 Broadway, New York 4, N. Y.

61255

ASK THE MAN FROM

## ANACONDA

ABOUT ALL-BUTYL SHOVEL CABLE

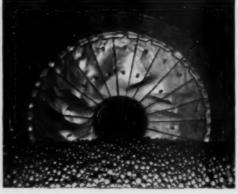


Amsco dippers last longer loading ore cars. Owners of this mine have converted over 90% of their shovels to Amsco dippers like this 6 cu. yd. model because of their toughness

and resistance to abrasion. Excellent Amsco service had a part in the decision, too. This shovel loads about 6,300 tons of ore per 8-hour shift.



1000 hours of sand harvesting before major servicing. That's the record of this Amsco 6". It pumps 1,200 gallons of 15% sand solution per minute.



Amsco offers the widest available range of liner designs and special alloys for ball and rod mill liners to suit all conditions of impact and abrasion. Each mill is custom engineered for smooth flowing design and long liner life.



Crusher roll life is increased 5 to 10 times with "Pair for Wear" electrodes—Nicro Mang\* for manganese steel welding and X-53 for general hardfacing.

For further information, circle the following numbers on the reader service card: 36—Dippers; 37—Pumps; 38—Mill Liners; 39—Nicro Mang and X-53 Electrodes; 40—Simplex Teeth.

\* TRADEMARK REGISTERED



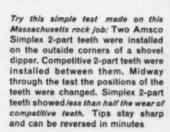
## **AMSCO WEAR PARTS**

help you handle more tons per dollar

Impact and abrasion take their toll of wearing parts and cut deep into your profits. Worn dipper teeth, pumps, crusher rolls, dozer end bits and mill liners can cut tons off your production.

Amsco alloy castings include manganese steels, chromemoly steels, multiple alloy engineering steels and high chromium iron—all developed to meet your specific needs whether it be impact, abrasion, or both. Each type is carefully guarded for proper chemical and physical properties and uniform heat treatment.

If wearing parts on machinery increase costs per ton you'd better investigate Amsco alloy wear parts. Your nearby Amsco representative can analyze your particular application and recommend an Amsco alloy product that will produce or move material at the lowest operating cost per ton. If you don't know his name, write and we'll send you his address.





Brake Shoe

They're backed by experience ...

Other plants in:

Denver • Los Angeles • New Castle, Delaware Oakland, California • St. Louis IN CANADA: Joliette Steel and Manitoba Steel Foundry Divisions

IN MEXICO: Amsco Mexicana, S.A.

Welding products distributed in Canada by Canadian Liquid Air Co., Ltd.

AMSCO

AMERICAN MANGANESE STEEL DIVISION CHICAGO HEIGHTS, ILLINOIS

## SME Announces . . .

# AIME TRANSACTIONS (MINING)

## Volume 220, 1961

As Transactions papers are accepted for the forthcoming volume, the titles and abstracts will be published in MINING ENGINEERING. The continuing list appears below. Watch for additional announcements which will be listed on the "Contents" and "SME Bulletin Board" pages in future issues.

## Anticipated Publication Date: December 1961

## Abstracts of the following papers appeared in previous issues (May and June):

59AU210 (Underground Mining) Blasting Theories and Seismic Waves. Part 1: Resume of Recent Blasting Theories by Arthur W. Ruff.

59AU109 (Underground Mining) Blasting Theories and Seismic Waves. Part II: Seismic Wave from Plaster and Drill-Hole Explosive Charges by Arthur W. Ruff.

60F106 (Coal) Experimental Work in the Degasification of the Pittsburgh Coal Seam by Horizontal and Vertical Drilling by G. R. Spindler and W. N. Poundstone.

60F65 (Coal) Daily Maintenance and Complete Overhaul of Continuous Miners by Joseph Mason.

60B232 (Minerals Beneficiation) Fatty Acids as Flotation Collectors for Calcite by M. H. Buckenham and J. M. W. Mackenzie.

TN 60B225 (Minerals Beneficiation) Heavy Media Grinding by H. J. Oberson and J. H. Brown.

TN 60A214 (Mining) Lined-Cavity Shaped Charge and Its Use as a Drilling Tool by Carl F. Austin.

59B78 (Minerals Beneficiation) Flocculation—Key to More Economical Solid-Liquid Separation by Robert H. Oliver.

59F117 (Coal) Investigation of Materials and Methods of Construction Used for Stoppings in Coal Mine Ventilation Systems by Charles T. Holland and W. J. Skewes.

611222 (Geology) Magnetic Taconites of the Eastern Mesabi District, Minnesota by James N. Gundersen and George M. Schwartz.

60B72 (Minerals Beneficiation) Recovery of Molybdenum by Liquid-Liquid Extraction from Uranium Mill Circuits by C. L. Lewis and J. E. House.

60B5 (Minerals Beneficiation) Size Distribution Shift in Grinding by G. Agar and R. J. Charles.

60L83 (Geophysics) Model Studies of an Apparatus for Electromagnetic Prospecting by H. E. Swanson.

TN 60B213 (Minerals Beneficiation) Flotation of Cummingtonite by I. Iwasaki, S. R. B. Cooke, and H. S. Choi.

**60B103** (Minerals Beneficiation) Fracture and Comminution of Brittle Solids by J J. Gilvary and B. H. Bergstrom.

TN 60B228 (Minerals Beneficiation) Size Distribution Resulting from the Comminution of Heterogeneous Materials by D. W. Fuerstenau.

61L6 (Geophysics) Relationship of Graphite in Soils to Graphite Zones by William H. Dennen and Harold Linder.

60B102 (Minerals Beneficiation) Energy Aspects of Single Particle Crushing by B. H. Bergstrom, C. L. Sollenberger, and Will Mitchell, Jr.

60H48 (Industrial Minerals) Some Beneficiation Techniques Applicable to Mineral Fillers by Donarl R. Irving.

NOTE: Copies of papers will NOT be available until after publication.



## Russia, Cuba in Joint Nickel Project

An agreement has been made between Cuba and Russia under which the former will export \$120 million worth of nickel and cobalt concentrates to the Soviet Union. Russia has agreed to send technicians to manage the research and survey projects, supply machinery and mining materials not available in Cuba, and provide specialists to initiate and maintain the mining project. The plant designated for the project is expected to produce 140 million lbs of nickel per year. It is reported that the Cuban processing facilities which will supply the Soviet Union were built by U.S. government funds.

## Montecatini To Design Aluminum Plant in India

An agreement has been signed between Montecatini and the Madras Aluminum Co., Ltd. of India for a 10,000 ton per year aluminum plant in the state of Madras in southern India. The plant will produce aluminum ingots and alloys from local bauxite ores. Montecatini will design the new installations and will supply complete technical assistance.

## Liberian Iron Ore Production Expected To Exceed Rubber Output

Liberia's Secretary of Commerce and Agriculture, Stephen Tolbert, predicted that Liberian iron ore shipments will exceed rubber output for the first time in 1961. Rubber production in 1961 is expected to be about 100 million lbs (dry rubber content) worth \$35 million. Iron ore exports reportedly will reach the level of 3,750,000 tons with an approximate value of \$40 million. As a result, government revenues, which increased by one-third to \$32 million in 1960 as ore shipments grew, are expected to make an appreciable rise. This will permit further development of roads, schools, hospitals and public health projects, agriculture, and electric power.

## Foundry Plant To Be Constructed in Peru

On June 9, Metalurgica Peruana S.A. announced conclusion of negotiations with National Malleable & Steel Castings Co. providing for technical and engineering assistance by the latter company in construction of a foundry for iron, steel, and non-ferrous metal castings near Lima, Peru. The projected foundry, the first in Peru capable of producing major industrial steel castings, will have an initial annual capacity of 20,000 tons.

#### USSR Claims Increase in Lead Production

The Economic Council of the Altai region of East Kazakhstan claims that production of lead ore and metal in that area is expected to be doubled. This area reportedly contains one of the richest deposits of non-ferrous and rare-earths metals in the Soviet Union. Large amounts of zinc and copper, as well as such rare metals as selenium, indium, cadmium, and tellurium are also expected to be exploited from several shallow deposits in the area.

## Secretary Udall Approves Anthracite Drainage Project

Secretary of the Interior Stewart L. Udall has approved a \$165,000 anthracite mine-water-control project near Nanticoke, Pa. The project, financed jointly by the Federal government and the Commonwealth of Pennsylvania, is designed to improve the surface-drainage area overlying the Glen Alden Corp.'s Wanamie mine. Completion of the project is expected to prevent an estimated 60 million gal of water from entering underground workings of the Wanamie mine each year.



## Reduction of Stockpile Inventory Urged

Representative Albert Thomas (Dem. Texas), chairman of a House Appropriations subcommittee has announced that the Nation's stockpiles of some \$8.5 billion of minerals and materials should be reduced by about \$2 billion during the coming fiscal year. He admitted that world markets would be disrupted by such action, but said that some plan to dispose of unessential quantities of strategic metals and minerals should be worked out.

## **New Coal Mine Opening**

A new coal mine, providing employment for some 400 persons and having an annual capacity of 1,200,000 tons, will be developed jointly by Republic Steel Corp. and Island Creek Coal Co. A new Corporation, the Beatrice Pocahontas Co., will be formed by the two companies. The Beatrice mine, located in Buchanan County, near Grundy, Va., will yield a high quality, low ash, low sulphur, Pocahontas No. 3 seam metallurgical coal.

## Garfield Smelter Achieves Remarkable Safety Record

Kennecott Copper Corp.'s Garfield smelter has compiled a commendable safety record—one full year (1,750,000 man-hours) without a lost-time accident.

## General Beryllium Acquires Claims in Utah

General Beryllium Corp. has acquired some 260 claims and several State Leases in the Spors-Topaz Mountain area of Utah. The company's holdings total approximately 5500 acres constituting one of the largest claim holdings in the area. The claims are located approximately 50 miles northwest of Delta and 100 miles southwest of Salt Lake City.

## U.S. Smelting and Stauffer Chemical Undertake New Project

The United States Smelting Refining and Mining Co. and a division of Stauffer Chemical Co. are jointly undertaking the construction of a plant employing a new process for the manufacture of coke from Utah coal. Construction of a commercial retort and auxiliary coal and coke handling facility will be started immediately on a site adjacent to the lead-zinc flotation mill of U.S. Smelting at Midvale, Utah, a few miles south of Salt Lake City. Completion is expected in the latter part of the year.

## Alcoa to Establish \$100 Million Aluminum Complex in Australia

It was announced on June 14 that Alcoa of Australia Proprietary Ltd., has been formed to establish and operate a \$100 million integrated aluminum complex on that island continent. The new concern, to be owned 51 pct by Aluminum Company of America and 49 pct by a group of leading Australian mining companies, plans to begin construction by the end of this year and to commence operations within 24 months. The new company will mine and refine high grade bauxite in the vicinity of Kwinana on Australia's west coast, then transport the resulting alumina to Geelong, 1700 sea miles to the east, where smelting and fabricating plants will be located.

### **Great Lakes Ore Fleet Reduced**

It has been reported that an increasing number of ore-carrying vessels in the Great Lakes are being scrapped. As a result of high operating costs and rising imports, the iron ore fleet has been reduced to 265 ships—52 fewer than last year. Presently, only 41 pct of the ships are operating compared to 92 pct a year ago. Shipping season this year is expected to end by November 1, the earliest since 1939.

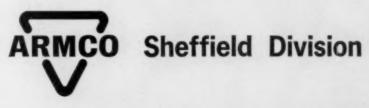


# SHEFFIELD MOLY-COP Grinding Balls



# has earned customer

acceptance More than a million tons of Sheffield Grinding Balls, used in every kind of grinding job, have performed with dependability around the world. Top performance can be expected from Moly-Cop because Sheffield alloying, heat-treating and forging are kept consistently uniform by Sheffield constant quality control. Result: Moly-Cop Balls retain their sphericity longer, to give a better grind at lowest cost per ton. The Standard of Comparison Around the World. Sheffield Plants: Houston, Kansas City, Tulsa



# Two cost-whacking Payhauler units equal five 11 cu.yd.haulers

-for Quality Lime Products Corp., Sumterville, Florida

Up the soupy, slippery ramp, the 95 Payhauler steadily climbs out with its 27-ton loads of lime rock. Dragline excavated from underwater, the dripping wet rock keeps the ramp sloppy, while being hauled up to the stockpile.

Quality Lime Products Corp., Sumterville, Florida, has proved that two 95 Payhauler units match production of five 11-cu. yd. end-dumps. The savings in labor and operating cost are huge!

Only two rigs to man, fuel, and maintain instead of five. Only minimum dead weight to move. Payhauler has the International-developed weight-shedding corrugated body, that increases tontoting capacity and climb-ability.

"On this wet ramp operation, the DT-817 engine, through torque converter transmission, assures maximum tonnage without loss of traction," states Superintendent W. W. Reynolds. "The Payhauler is well-balanced, easy to operate, and operator acceptance has been excellent. Each '95' stockpiles up to 1,500 tons of material per 10 hrs., hauling 1.3 miles."

Power-punch of the 27-ton 95 Payhauler is the International DT-817 diesel—turbocharged to deliver 375 high-torque hp, through power-shift torque converter or 9-speed air-shift transmission. The 19-ton 65 Payhauler is also powered by the "817," naturally aspirated to produce 250 hp through 10-speed constant-mesh transmission.

And both Payhauler models have full-torquetaking planetary final drive design—reserve area power braking—"one-hand," road-holding power steering—11-second dumping.

Compare Payhauler grade charts—compare cycle-gaining Payhauler performance on grades and tough hauls. Size-up Payhauler dependability and long life features. Let your International Construction Equipment Distributor demonstrate.

In typical slippery, sloppy going, a 95 Payhauler climbs with its full load of wet lime rock—for Quality Lime Products Corp., Sumterville, Fla. The ramp rises 40 feet, and has two turns, in the first 500 feet of the haul!

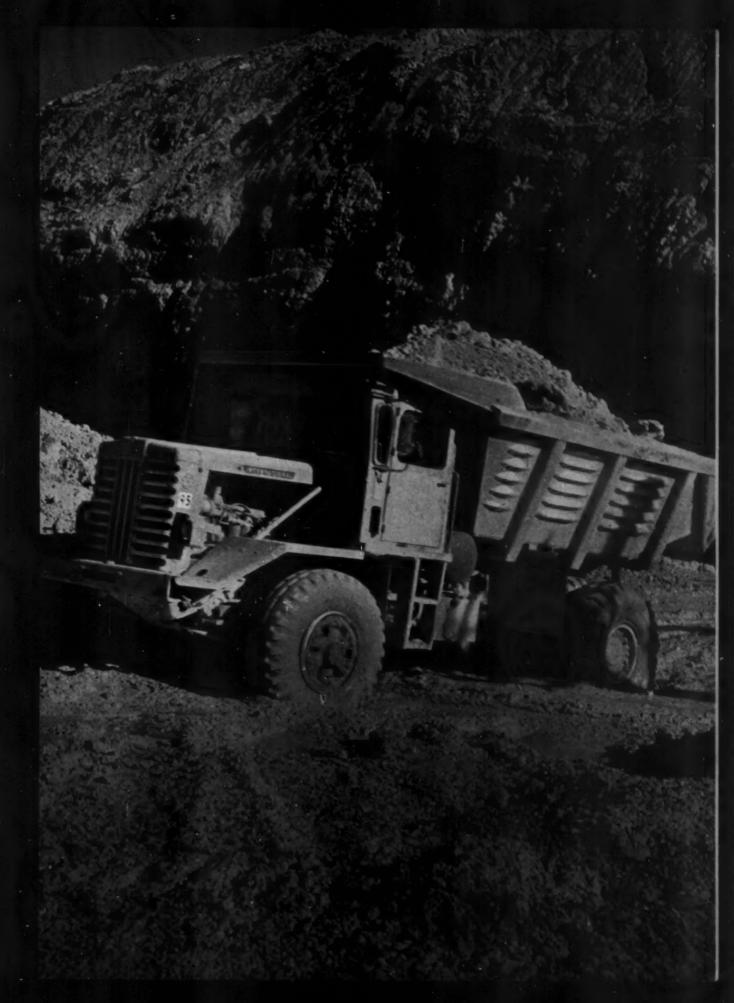
With exclusive action-speeding, inverted hoist design, a 95 Payhauler dumps its load in only 11 seconds, ready to high-tail back for another load. The lime rock is air dried, then fed to crusher by dozer and dragline to produce road base and stabilizing material.





International Construction Equipment

International Harvester Co., 180 North Michigan Avs., Chicage 1, Illinois A COMPLETE POWER PACKAGE



# "ECONOMICS of the MINERAL INDUSTRIES"

- Foreword by the Honorable Herbert Hoover
- Edited by Edward H. Robie, former Secretary of AIME
- Text by 36 industrial, legal, and financial experts

Here is the first book to be released for many years on Mineral Economics. It is the most comprehensive volume ever published on the subject . . . expertly written and edited by top men in the field, as a memorial to Harvey S. Mudd

For everyone active in any phase of the mineral industries, it will be an invaluable reference source. Young men just starting their careers in geology, mining, metallurgy, or

petroleum will find it an ideal means of broadening their knowledge and preparing for added job responsibilities.

Of equal importance, "Economics of the Mineral Industries" will be valuable to experienced engineers and executives to help them keep in touch with the latest in methods and practices. In fact, everyone who has any relation with the mineral industries will find something of direct interest in some of the chapters.

### CHAPTER

- 1. The Significance of the Mineral Industries in the Economy, by Charles White Merrill.
- Distinctive Features of the Mineral Indus-
- tries, by Charles H. Behre, Jr.

  Mineral Titles and Tenure, by Northcutt Ely, assisted by Charles F. Wheatley, Jr.
- 4. Valuation of Mineral Property, by L. C. Raymond.
- 5. Cost of Acquiring and Operating Mineral Properties-Part 1. Metal, Nonmetallic, and Coal, by Paul M. Tyler. Part 2. Petroleum and Natural Gas, by John R. Crandall, J. W. Glanville, L. Cookenboo,
- E. D. Pressler, and L. H. Thompson. 6. Part 1. Mine Financing, by William F. Boericke and Carroll C. Bailey. Part 2. Bank Loans on Oil and Gas Produc-
- tion, by C. R. Dodson. 7. Part 1. Marketing of Nonferrous Metals and Ores, by S. D. Strauss Part 2. Marketing of Industrial Minerals, by
  - Raymond B. Ladoo. Part 3A. Marketing of Iron Ore, by Franklin G. Pardee.
  - Part 3B. Marketing of Pig Iron, by George P. Krumlauf.
  - Part 4. Marketing of Petroleum and Natural Gas, by Serge B. Jurenev.

- Part 5. Coal Marketing and Trade, by Charles H. Lambur.
- 8. Dimensions and Changing Patterns of Supply and Demand, by W. C. Schroeder and Richard H. Mote.
- Part 1. Accounting for the Extractive Industries, by Maurice E. Peloubet. Part 2. Special Features of Petroleum Accounting, by Laile H. Thompson.
- 10. Taxation of Mineral Properties, by Granville S. Borden.
- Minerals in National and International Affairs, by Elmer W. Pehrson.
- Government Aid and Regulation, by Evan Just
- 13. Conservation and Stabilization, by John Drew Ridge.
- Labor-Management Relations in the Mineral Industries of North America, by Charles R. Kuzell and W. J. Uren.
- 15. Industrial Research-Its Aims, Organization, and Facilities, by D. Swan.
- Gold and Silver-Money and Credit, by Charles White Merrill.
- Nuclear Energy, by Corbin Allardice and Charles T. Baroch.
- 18. Minerals in Man's Future, by Zay Jeffries.

The price of "Economics of the Mineral Industries" (770 pages) is \$10.00, less a 30% discount to members of AIME. (Extra postage to nonmembers outside of the United States, 50 cents per copy.)

29 West 39th Street, New York	ing, Metallurgical, and Petroleum Engineers 18, New York
Please send me copy	(copies) of "Economics of the Mineral Industries".
Payment enclosed	Please bill me (AIME Members
Name	AIME Member?
Street	
City	State

# LE ROI LRD-2 for low cost,

powerful rotary drilling

rotary or down-the-hole drilling ... gas or diesel

These rigs come

on tires or tracks!

Here's a highly portable blasthole drill for drilling holes up to  $4\frac{1}{2}$  inches as deep as 30 feet ... equipped for either positive-drive rotary drilling or powerful down-the-hole percussive drilling.

What's more, the LRD-2 is completely self-contained ... and economically priced, too!

The entire unit is easily handled by one man. Controls are conveniently grouped at an operator's station located alongside the drilling area. The unit can be moved, leveling jacks hydraulically set, mast hydraulically raised, drill pipe and bits connected, and hole started all with a few non-fatiguing motions.

Powerful direct mechanical drive keeps the rotary table turning won't bog down or lose torque under rough going like air or hydraulic driven units — eats through tough rock formations under 10,000 lbs. pulldown pressure at speeds from 40 to 250 rpm. If necessary, a hard-hitting down-the-hole drill can quickly be substituted for the rotary bit to drill extremely hard rock formations.

A Le Roi 25 hp two-stage air compressor provides ample air for powering the down-the-hole drill and cleaning out hole . . . or is available in single-stage where only rotary drilling is necessary.

The self-propelled LRD-2 is available either on crawler or tire mounting and with either gasoline or diesel power unit. A whole list of extra equipment is available to ease or speed drilling, including lights for night-time operation, a mounted bit grinder, air hoist, breakout tongs, water injection system, . . . all detailed in Specification Sheet AT-146. Write for your copy.



division of Westinghouse Air Brake Co.

Sidney, Ohio





# WHY IT COSTS LESS TO OWN A CAT GRADER

Most motor graders look pretty much alike, no matter who makes them. They handle similar jobs, too, and it isn't always easy to see any big difference in the way they handle them. In fact, the manufacturer's suggested prices usually are not greatly different for machines of nearly equal specifications—regardless of the "deal" that may be offered a buyer. But used motor graders vary considerably in price. Why?

# The Buyer Determines Price

A used machine is priced at what the buyer is willing to pay . . . it's a measure of what he thinks is left in a machine. So, with used equipment, the buyer sets the price. This is clearly demonstrated at used equipment auctions. A check of auction prices throughout the country shows, for example, that the Cat No. 12 Motor Grader brings substantially higher prices than comparable machines of other makes-as much as 80% more. (Only machines of the same age, same condition and with similar attachments were compared.) What makes a Cat Motor Grader more desirable than other makes?

### A Feature That Affects Cost

Any machine is desirable if it is known to be dependable. This reputation can

only be the result of true quality design and quality construction. The Cat oil clutch is a good example. It was designed and is built to give long, trouble-free life. But, how well does it do it? Let's examine the records of just one Caterpillar Dealer who has 161 oil clutch-equipped motor graders in his territory. His records show that in four years he has sold only \$24.38 worth of parts for motor grader oil clutches! One machine in his territory went 2524 service meter hours without any work on the clutch. Many users report 2000 hours of service before the first adjustment. In 1000 hours of operation only about .0025 inch of wear can be expected-less than the thickness of a human hair. And, since all parts are constantly bathed in oil there is no need for lubrication maintenance. Less wear, less attention mean not only lower total repair costs but more time on the job ... less down time. Of course, the oil clutch is just one example of many quality features in Cat Graders.

### A Look at Total Cost Records

The cost records of private owners and governmental bodies show which machines cost less. For example, an Indiana county keeps individual cost records on their six motor graders, 14 trucks, three loaders and five tractors.

Their records showed that a year-old No. 12 needed only a set of head gaskets and two spark plugs with \$25 labor, while two newer graders of another make needed major engine repairs, new clutches and side shift linkage. One town in New Hampshire reports that in over 20,000 hours, their No. 12 has never had a breakdown that held up work more than three hours. Operating costs-24¢ per hour exclusive of fuel, oil and operator. Comparing a Cat No. 12 to another make (after 31/2 years' service), the records of an Arkansas county showed a saving of \$2478.57 in parts and labor for their No. 12.

### What's in It for You

Others have proved that Cat Motor Graders cost less in the long run because they are built better in the beginning. Your Caterpillar Dealer has additional facts and figures on low-cost operation of Cat Graders in your area. Ask him for free Cost Record Books so that you can keep individual machine records on your equipment. Prove to yourself that it costs less to own a Cat Grader.

Caterpillar Tractor Co., General Offices, Peoria, Ill., U.S.A.

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# Are We Wasting Land Resources?

Conflicting interests in the use of United States land resources is the subject of a symposium of four articles starting on page 709 of this issue of Mining Engineering. Efficient use of land is a concept which everyone favors but one that also becomes fraught with controversy when particulars are being worked out. Our authors render a general view of the conflicts between mining and other economic activities and discuss the minerals industry position in relation to public land withdrawal, urbanization, and water reservoirs.

In western United States and Alaska, large areas of the public domain are reserved for restrictive and special uses. The National Park and Monument reservations are cases in point; cases of which we are very proud and whose effective use we do not question. On the other hand, withdrawals for so-called exclusive "wilderness" areas when immense acreage is involved, are open to question.

Population growth places increasing demands on land utilization for living, agriculture, and water on the one hand, and mineral raw materials and forest products on the other. Forest products are replaceable natural resources; but because of the time cycle in replacement and heavy demand made by population on these commodities, there is a definite limit to the amount of usable land which can be withdrawn from this activity. Mineral raw materials are in a different category because once used, they cannot be replaced. If we exclude large areas of the country from mineral development, we hasten the day of total dependence on foreign sources. A "wilderness" area may be a luxury the nation cannot afford. An undeveloped reserve with controlled utilization of resources commensurate with principles of conservation is more realistic to national requirements. When one considers the enormous land mass behind the Iron Curtain, there is little doubt that efficient utilization of our land is obligatory.

The trend toward urbanization is even more pronounced than can be explained by population growth. This has had a detrimental effect on the sand and gravel business. With proper planning and controls, full utilization of these resources may be maintained. It would be infringing on our authors to elaborate on solutions which you will find are both sound and salubrious.

Mineral industry consultants are profitably employed by government agencies and national regulatory bodies but it appears that in the trend toward urbanization a greater utilization of them might be made by town planners.

The present outdoor season during which we take great pleasure in the natural beauties of our country lends interest to this discussion, but the pending Senate Bill 174, "A National Wilderness Preservation System," gives it urgency. Over 50 million acres are involved in the proposed legislation for withdrawal and restricted use. Under the stress of booming population, dwindling natural resources, limited land availability, and "cold war" threats, how can the problem be viewed in other terms than the efficient use of land resources? We have used the expression "conflict of interest" in describing the pressure on land utilization. But you will quickly see in reading these articles that in fundamentals there is no "conflict." With proper planning by all parties, multiple land use by the public, business, and industry results in the efficient use of land by all, with the desired dignity of living.



After analyzing preliminary results of Anaconda's

# **NEED FOR IMPROVEMENTS SPARKS**

by RICHARD M. STEWART and CHARLES M. MacQUEEN

A naconda's Berkeley pit at Butte produces 34,000 tpd of ore averaging 0.8 pct copper. Two-and-one-half tons of waste is stripped per ton of ore, approximately 40,000 tpd by the company and an added 45,000 tons by the F&S Contracting Co. The company truck fleet consists of 24 Euclid and 18 Mack 34-ton, rear-dump diesel trucks.

Progressive stripping is lengthening haul and increasing vertical lift. Some waste hauls are now over two miles one-way, with vertical lift over 500 ft. Waste dumps build up rapidly because the disposal area is limited. Restricted by residential and commercial area, all waste must be hauled to dumps extending northward from the pit. This terrain rises on a 4 pct grade. Haulage grades on dumps vary from 4.5 to 5 pct, so there can be little increase in dump volume as the haulage distance increases. At equal haulage distances, a dump carried on a 15 pct

grade will have 3.33 times the capacity of a dump carried on a 4.5 pct grade, the volume varying directly with the grade. Under these conditions the urgency of increasing haulage grades is evident. Grades within the pit average about 7 pct, and are becoming longer as the pit expands and deepens. Present haulage fleet life is approaching maturity. These factors create the need for additional trucks, and pose a method-study problem in materials handling. To afford temporary relief, ten new 34-ton Macks have been leased; but a long-range solution to the problem is being sought.

# RUGGED TESTS PLANNED

The first objective of Anaconda research was to develop a haulage truck capable of hauling double the load, up grades twice as steep as those in use at the time, at speeds twice those possible with the conventional equipment. In truck haulage problems, the variables of capacity, performance, and maneuverability must be balanced to achieve low

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experiments with the electric truck . . . .

# CONTINUED TESTS AT BERKELEY PIT

cost. Several high-capacity Diesel trucks are available that could provide the increased capacity, performance, and maneuverability that is being sought; but when grades of 15 pct are considered, the fuel and maintenance costs cannot be justified. A vehicle having far higher horsepower than available in conventional diesel trucks was deemed necessary for the solution of the waste haulage problem at the Berkeley pit.

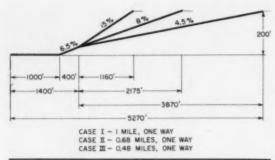
General Electric Co. and R. G. LeTourneau Co. have been developing electric wheels of 150 to 400 hp and with large-diameter, wide-base, tubeless tires. Power for the wheels is provided from a diesel-engine-generator set, and it may be supplemented with electric power from a trolley collector system. This type of wheel eliminates the need for conventional high-cost mechanical power transmission through torque converters, drive lines, and differentials.

Electric-wheel vehicles showed promise of the following advantages:

- Higher horsepower permitting increased capacity and gradeability.
- 2) Fewer trucks for comparable tonnage.
- Make more dump room available in limited area through increased dump gradient.
- Reduced maintenance cost by elimination of mechanical and hydraulic systems.

Several companies were asked to submit proposals for electric trucks that would fulfill these objectives. Following extensive negotiations, a prototype straight-electric truck was purchased from LeTourneau for testing at the Berkeley pit. A suitable test location was selected and necessary trolley was installed on a 15 pct grade.

The TR-60/335 is a 4-wheeled, 60-ton capacity, modified semi-trailer, rear-dump vehicle having a 335-hp engine. A connecting yoke with large ball-and-socket joints allows a high degree of differential movement between the front and trailer ends. A similar connecting apparatus between front axle and front-end assembly gives a relatively smooth



	CASE I	GRADE
TRUCK	HAUL RATE (TPH)	COST PER TON (¢)
450 HP, 34-TON DIESEL TRUCK	131	7.9
700 MP DIESEL -	222	7.44
TR-60/335 HP STRAIGHT-ELEC	205	6,96
TR-60/670 HP STRAIGHT-ELEC	238	7.26
0	100 200 300 0	123456789
TRUCK	MAIN HAUL ON 8% (	COST PER TON (#)
450 HP. 34-TON	141	740
DIESEL TRUCK 700 HP DIESEL - ELECTRIC	238	6.94
TR-60/335 HP STRAIGHT-ELEC	245	5.82
TR-60/670 HP STRAIGHT-ELEC	284	6.08
ò	CASE III	
TRUCK	HAUL RATE (TPH)	COST PER TON (¢)
450 HP, 34 - TON DIESEL TRUCK	152	6.86
700 HP DIESEL-	253	6,53
TR-60/335 HP STRAIGHT-ELEC	283	5.04
TR-60/670 HP		5.59

ride over uneven ground by permitting axle rotational deflection.

Each of the four wheels is powered separately by 400-hp, d-c motors mounted in the massive box-section axles. Suitable gear reduction between the motors and the wheel rims provides the high torque requirements on steep grades.

Four large 89-in. OD, 48-ply widebase tubeless tires carry the nominal 120-ton gross weight vehicle and also serve as the truck suspension system. The weight distribution between the front and rear axles varies from 54 to 46 pct empty to 40 to 60 pct loaded.

All truck controls are regulated by the driver through hand switches and rheostats on control console. Power for steering is provided by a vertically mounted a-c motor on the trailer section. The motor drives a pinion gear through primary and secondary gear boxes which in turn is engaged with the horizontal steering rack integral with the front end of the truck. By turning this rack, the front end turns and permits steering up to 45° right or left.

Dumping is accomplished electro-mechanically by a rack-and-pinion dump mechanism. A traveling a-c motor is pinion-gear connected to, and runs on, a toothed rack which is integral with the main longitudinal frame member. Simple mechanical linkage between motor housing and pivoted body transmits the lifting effort as the motor moves over the rack toward the rear.

The truck is specified to haul 60 tons up a 15 pct grade 13 mph on a haul road with 40 lbs per ton rolling resistance. The attained performance has been 63 tons up a 15 pct grade at 10 mph with an estimated 60 lbs per ton rolling resistance.

### **ELECTRIC TRUCK SHOWS PROMISE**

The diagram and chart (left) illustrate the road grade and length of haul conditions for the three tests studied, and the comparison of trucks with respect to haul rate cost per ton, and the haul rate ratio of each, compared to the 450 hp, 34-ton diesels. The comparison is made for each truck in three haulage situations. In each case a level bench run of 1000 ft is followed by a 400 ft section of 6.5 pct with the remainder of the run on either 4.5, 8, or 15 pct grade to gain a total elevation of 200 ft to a level dump area. The first 500 ft of the run for the straight electric trucks was made on diesel-electric power with the remainder of the run being made on trolley.

On this basis, the truck with lowest cost per ton on all grades is the TR-60/335 hp straight-electric. However, it is necessary to eventually build the dump gradient to a higher elevation by cross-ramping on about a 10 pct grade; the loaded speed of this truck on these grades is too low to be practical in a production situation. The TR-60/670 hp vehicle is the lowest cost truck that will meet the requirements.

Performance of the 700 hp diesel-electric and the TR-60/670 hp loading from a 10.5 cu yd shovel is shown in Table I. The 700 hp diesel-electric haul

Table I. Comparison of Performance and Cost Per Ton Estimates

	440 110	800 MB	TT 40.000	TR-6	10/670	700 HF	
	450 HP Straight Diesel	Straight	700 HP Diesel- Else.	TR-60/335 Straight Elec.	Straight Elec.	Straight Elec.	Diesel- Elec.
Fruck empty weight, tons	35	57	56	57	57 10.5	57	
Shovel bucket capacity, yards	6	6	6	6	10.5	10.5	
Shovel passes per truck	4	7	7	7	4	4	
Payload tons per truck	36 71	63	63	63 120	63	63 120	
Gross vehicle weight, tons	71	120	119	120	120	120	
loading time, including delays	2.53	4.24	4.24	4.24	2.94	2.94	
rucks loaded per shovel hour	23.6	14.1	14.1	14.1	20.4	20.4	
faul capacity, tons per hour	850	888	RBB	888	1285	1285	
Maximum shovel rate per hour	1148	1148	1148	1148	1836	1836	
shovel capacity, tons per shift	6375	6660	6660	6860	9180	9180	
Shovel—fleet operating effic.	74%	77.5%	77.5%	77.5%	70%	70%	
length of haul one-way, miles	1.0	0.68	0.48	0.48	0.48	0.68	
Main haul grade	4.5%	8 %	15%	15%	15%	8%	
Elevation gained in feet	200	200	200	200	200	200	
Round trip time in minutes	13.68	13.24	11.11	10.22	8.92	11.94	
Fons hauled per 50-minute hour	131	238	283	309	353	264	
Trucks required per shovel	6-7	4	3	3	3-4	5	
Istimated Truck Costs							
Cost per operating hour	\$10.43	\$16.91	\$14.26	817.28	\$15.20	\$16.59	
Cost per ton hauled, cents	7.963	6.937	5.038	5.592	4.307	6.28	
Percent variance from 34-T diesel	7.800	-12.88%	-36.73%	-29.77%	-45.91%	-21.08	



The TR-60 as it first appeared in the Berkeley pit in 1960 (above). At the right, a close-up of this truck shows the unique dumping method which it employs. The truck body is geared directly to the chassis and, at the touch of control switch, a traveling motor and pinion moves along a gear rack to raise body to dumping position. Recently, truck power was doubled to 670 hp.

rate would increase about 10 pct and the cost per ton decrease a corresponding amount. The haul rate of the TR 60/670 hp would increase about 15 pct and the cost per ton decrease more than 20 pct. So, as expected, shovel size is another consideration in the search for lower cost per ton.

The TR-60/335 met test conditions, but further developments were required before wheel traction motors could withstand the severe conditions imposed by steep grades. A cooler-running electric motor with better commutation is required. It is felt that the wheel motor problem is one of electrical design that will be solved, and that the truck will ultimately take its place as a reliable production haulage unit.

### DESIGN PROBLEMS FOUND

Additional design limitations of the truck include insufficient traction power for off-trolley manuevering and the need for relocation of some electrical and mechanical components. A number of changes in the driver's control console have also been recommended for simplification of truck control and for monitoring wheel motor operation. (Truck modifications to alleviate these conditions were completed in March 1961, and the modified TR-60/670 is now in service).

The actual production performance has been variable due to 1) "shake down" of a prototype vehicle with attendant field modifications, 2) trolley line changes, relocations, and extensions, plus 3) adjustment to pit production requirements.

Attained haul rate during the test was 205 tph (Table II) under these conditions compared to a calculated 238-tph theoretical capability under average loading and haulage conditions. Considering work time only, a rate of 300 tons per 50 min work hour was attained. In view of this, a production truck of this type should easily maintain the calculated rate on a comparable haul.

It is too early yet to predict the ultimate tire life on a truck of this type. The initial cost per set and the corresponding cost per ton for these large tires is about three times that of present tire costs based on an average life of 3000 hrs for the large tires versus 4000 hrs for the small tires. This cost can be



absorbed by power and maintenance cost reductions. Further, it is reasonable to expect that the eventual cost ratio will become more favorable as the use of the larger tire is extended.

This brief discussion of preliminary electric truck testing at the Berkeley pit, and the relative capabilities of diesels, diesel-electrics, and straight-electric trucks emphasizes the fact that the wider choice of trucks becoming available to operators with difficult haulage situations will enable them to select vehicles more suitable to their particular conditions than has been possible in the past. This choice could result in substantial savings in cost-per-ton stripped. Tests described began April 1960 and continued intermittently through the middle of November.

As a matter of interest, a LeTourneau-Westing-house "Haulpac 60" and a diesel-electric truck with capabilities similar to the diesel-electric used in the calculations are being operated by the F&S Contracting Co. in the Berkeley Pit. A comprehensive study of these trucks is underway and it will be interesting to compare results with these preliminary calculations.

Table II. Summary of Electric Truck Performance at the Berkeley Pit, July Through November, 1960

Days worked	47 922
Tons hauled	58,056
Average haul distance, one-way	0.5 mile
Average distance on trolley	0.3 mile
Tons per hour, working	300
Tons per hour, operational	205
Tons per hour, overall	154
Pct of time, working	46.6
Pct of time, process delay	28.4
Pct of time, truck delay	19.4
Pct of time, trolley delay	5.6
Average availability	75.0
Production availability	41.6

Definition of terms:

Work time = load + travel + dump
Process delay = wait + lunch + personal + supervision
Truck delay = inspection + lubrication + repairs and adjustments
Trolley delay = trolley repairs and adjustments
Average availability = total time-truck and trolley delays
Production availability = days worked + total work days in period

# CENTRAL WASHERIES . . .

# KEY TO INDIA'S COAL PROBLEM

One primary objective of India's third Five Year Plan is the expansion of coal production. The goal: boost present output of 45 million tons to 95 million tons by 1965—an increase of more than 100 pct!

by G. G. SARKAR, A. K. CHAKRAVARTI and A. LAHIRI

eeting the increasing demand for superior grade coking coal for the iron and steel industry is an immediate problem in India today. Indian coals are, in general, high in ash and often have to be cleaned before use in industry. It has been estimated that the total demand for good coking coal for 1961 and 1965 would be about 10 and 17 million tons per annum respectively, of which about 7 and 13 million tons would have to be washed coal. The corresponding raw coal that will have to be treated in the central washeries is expected to be about 10 and 22 million tons (average clean coal yields 70 and 60 pct respectively). Total washing capacities by the years 1961 and 1965 have to be about 2000 and 4000 tph.

Most of the Indian collieries have small outputs, and coal washing at the individual mines does not prove economic as it is not possible for any one colliery to feed the entire requirement of a commercial washery. The solution lies in grouping a number of collieries with small outputs, into size washability categories, so that combined output can be fed to a washery of economic capacity.

In view of wide fluctuations in washability characteristics of the raw coals and the small output of most collieries, the choice of suitable washing schemes has presented difficult, if not unique, problems. Average cleaning characteristics of coking coals in India are "exceedingly difficult" or "formidable" types according to Bird's classification.

The Coal Washery Committee, organized by the Indian Coal Board in 1953 to examine and report on the problems relating to the establishment of coal washeries in India under such difficult conditions, advocated setting up of multiplant and integrated central washeries of large tonnages near the existing railway marshalling yards or base-

loading stations in the coalfields. Since the acceptance of these recommendations by the Government, a number of central washeries have been planned, some of which have already been put into commission while others are either being set up or are in the project stage.

# FACTORS IN PLANNING

In planning washeries to handle varying qualities of feed coal and small production from individual seams and mines, it often becomes imperative to broadly classify the potential reserves of coal available for washing into different categories on the basis of their washability characteristics. These different categories of coals are to be received and stored separately and treated in different washing circuits. If a number of collieries contribute to the raw coal feed of each category, pre-blending or pre-mixing arrangements are necessary so that possible inconsistency in quality and size of raw coal received, at least over a day, may be evened out as far as practicable. For this purpose, the storage space has to be large enough to accommodate at least 2 to 3 days' supply of coal. This is also necessary because of seasonal variation in the production of coal from individual collieries due to transport and climatic difficulties. The proportional supply from each of the collieries, as stipulated, may not be maintained in practice.

In some cases, the raw coal feed to a 500-tph two-shift washery will be drawn from not less than 25 to 30 collieries, each mining on the average three different seams, worked in most cases in two or three sections. But the most difficult feature of the problem is the variable washability characteristics and size composition of the individual coals. The layouts of these washeries therefore have to be made flexible enough to handle such fluctuations

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<sup>\*</sup> Report of the Coal Washeries Committee, 1954; published by The Coal Board Calcutta.

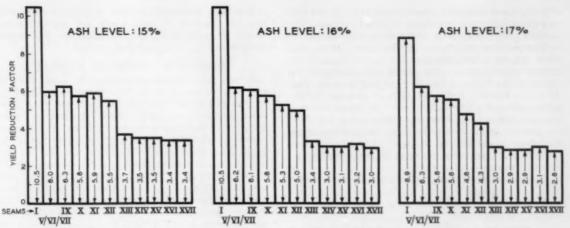


Fig. 1-Average yield reduction factors of coal seams in Jharia Field at various ash levels and 3-in. size.

and to guarantee at the same time the desired quality

Under the circumstances, there can be no other choice but to have "composite washing" systems for upgrading coals of such widely varying characteristics. These "composite washing" systems are suitable not only for efficiently cleaning the entire size range of raw coals but they also have the added advantage of being capable of dealing with a wide range of fluctuations in the quality of feed. They also exhibit flexibility of operation for adjustments of yield and ash content of the resulting washed products to the desired level. In case of wide fluctuations in quantity as well as quality of different consignments of raw coal, the simple blending of such coals fails to ensure a consistent feed to the washing units. Under these circumstances, the incorporation of a pre-washer helps in preparing a reasonably consistent feed. The factor behind this is that, after primary washing, all extraneous ash is removed so far as Indian coals are concerned. The feed thus prepared then consists largely of ash which is inherent and closely follows certain laws of coal and ash ratio vs. specific gravity. In selecting the units for composite washing, care should be taken to

48 0 0 Q PCT CLEANS 51 CURVE 3" 52 TOTAL VIELD! 53 54 56 M 14.5% ASH 17.5% ASH 15 16 10

Fig. 2—Curves showing recoveries of 3-in. to 0 coal at 16 pct ash, obtainable by washing 3 to 1-in. and 1-in. to 0 size fractions containing different ash levels.

consider the high degree of performance of the individual washing units in their specified ranges of operation.

Sites for central washeries are required to ensure minimum haulage of raw coal and to maintain as far as possible unidirectional movement of raw coal and of washed products. It is also important that the plant layout permit adoption of a more comprehensive washing system at a later stage if the quality deteriorates or the capacity of the washery is increased due to the improvement in supply or demand in future.

The Indian coals under discussion, invariably yield large quantities of middlings or saleable inferior grade coals (even the rejects contain only about 45 to 50 pct ash). Transport of such material over long distances will not be economic, and consideration has to be given to placing the coal washing projects so that the middlings and rejects may be consumed at site either for power generation or for making synthesis gas. The lump sized middlings can also be carbonized in situ and suitably disposed of as domestic coke.

(It may be mentioned that an American firm is building a 125 megawatt-power station at Chandrapura utilizing washery middlings and rejects containing about 45 pct ash. The fuel will be obtained from a 500-tph washery incorporating a prewashing technique which also is being erected and engineered by another American firm at a railway marshalling yard. The plan for this washery and specifications for fuel for the thermal power station have been prepared by the Central Fuel Research Institute.)

In a central washery of the type mentioned above, the technique of quality control by statistical methods, must ultimately, be resorted to, and for this purpose automatic samplers, weighers, density controllers, and a well-equipped laboratory have to be provided.

# CLASSIFICATION BASED ON WASHABILITY

Quality control for coals of varying washability characteristics becomes much easier if the coals are initially classified in terms of ash limits or ash ranges for a given gravity. Once the coals are classified they can be mixed in any proportion at the washeries as long as they belong to the same category, although the product's gravity range may vary widely. The possible extent of variations in the washability characteristics is represented in

Fig. 1. These coals are obtained from about 60 collieries involving more than a dozen seams. The results refer to average cleaning characteristics of individual seams determined by many tests, carried out on seam samples crushed to pass 3 in square-hole screens. The seams are numbered in order of the bottommost seam (designated as seam I) to the topmost seam (designated as seam XVII). The yield reduction factor, referred to in the diagram expresses the average reduction (or sacrifice) in percent yield of coal for each percent reduction in ash up to the desired limits of 15 to 17 pct ash in cleaned coal (as normally used in India for metal-lurgical purposes).

The general formula used in calculating the factors is as follows:

$$R = \frac{100 - Ye}{A\tau - Ac}$$

where R = yield reduction factor, Ye = percent cleaned coal yield, Ar = percent raw coal ash and Ac = percent cleaned coal ash. It appears that there is a trend for the yield reduction factors to increase from the topmost to the bottommost seam at the 15 to 17 pct ash level in the cleaned coal. It will be seen at the same time that the coals fall under three broad categories. The average specific gravities of cut for all the coals are also found to follow similar trends and are fairly close for each category of coal. These observations, therefore, justify classifying these Indian coals into categories based on their washing characteristics and designing equipment to treat each of these categories separately for maximum efficiency and yield. The yield reduction factors (which more or less define the washing characteristics of each individual seam) can often be used to predict with fair precision the recoveries of clean coal from a mixed feed if the overall ash content of the individual coals and the proportion of their blends are known in advance.

# DETERMINATION OF OPTIMUM WASHING CONDITIONS

In coal washing practices employing composite washing systems, due attention has to be paid to efficiency of separation effected in individual units within practical limits. The loss in yield of valuable coal due to wrong choice of specific gravity of cut and size-combination is often ignored. Recently a graphical method has been evolved which permits determination of the optimum separation densities and size gradation of raw coal feed in a composite washery to get a maximum yield of total clean coal (Fig. 2). The curve is obtained by plotting the yield of total cleans with a desired ash percentage as ordinate against ash percentage of component float products as abscissa. It may be observed from the curve that the maximum yield of total cleans can only be obtained by maintaining the ash levels of the composite size floats at the lowermost points (M + M') of the respective curves as indicated in Fig. 2. It follows that to obtain such results in practice, a judicious choice of the proper type of washing units has to be made on the basis of 1) size range of feed coal, 2) the optimum separation density, 3) the amount of near-gravity (± 0.1 sp gr) materials at the predetermined density.

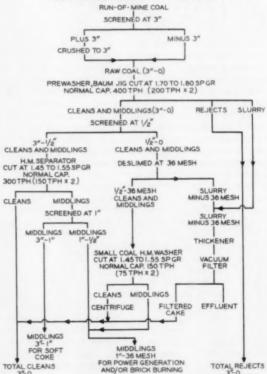
It has also been seen that where washing of two or more seams or two or more categories of coals is involved, maximum benefit in yield of clean coal can be obtained if such coals are washed separately in individual units at optimum ash levels, determined by the graphical method.

# CHOICE OF WASHING SCHEME

It has been found convenient to limit the top size of crushing to 3 in. for coking coals. A study of the numerous washability data (several hundred samples) on these coals (crushed to below 3 in.), shows that treatment of the entire sizeconsist of the coal in jigs is not possible due to the high proportion of near-gravity (± 0.1 sp gr) materials at the required specific gravity of cut (1.45 to 1.50 sp gr). Furthermore, a washing system consisting of jigs alone does not have the necessary flexibility of operation which is essential for the changing quality of the Indian coals. Also it is not desirable to crush coals to smaller sizes (minus ½ in. or below) owing to attendant dewatering and slurry problems. So far as India is concerned, it has been ascertained by elaborate tests that excepting a few coals or some of their size fractions, the theoretical increase in clean coal yield is so meager that there is hardly any justification to crush these coals to 1/2 in, or below prior to washing.

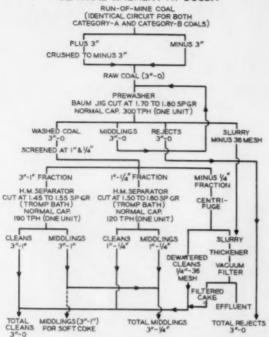
On the other hand, adoption of heavy-media separation alone for treating 3 in. to 0 size coal

# CENTRAL WASHERY AT PATHERDIH



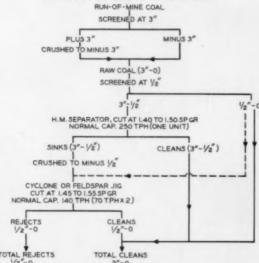
Patherdih washery will receive coals of only slight variability from approximately 20 collieries. The recommended washing circuit will employ two 200-tph Baum jigs to prewash 3-in. to 0 raw coal, two 150-tph H.M. rewashers to treat 3-in. to ½-in. prewashed coal, and two 75-tph cyclone washers (or other suitable small washers) to treat ½-in. to 36 mesh prewashed coal.

# CENTRAL WASHERY AT DUGDA



Dugda washery will employ two identical circuits for two categories of coals classified according to their washability characteristics. Each circuit includes a 300-tph Baum jig prewasher, one 190-tph H.M. rewasher for 3-in. to 1-in. prewashed coal, and one 120-tph H.M. rewasher for 1-in. to ½-in. prewashed coal. Category A coals will be supplied from about 10 collieries and Category B coals will come from about 20 collieries.

### CENTRAL WASHERY AT BHOJUDIH



Coals supplied to the Bhojudih washery will not necessitate a prewashing jig at that plant. The washery will have a 250-tph H.M. separator for treating 3-in. to ½-in. coal as well as two 70-tph cyclone washers for rewashing the sinks from the separator after crushing them to less than ½-in. and desliming at 36 mesh. The cyclone circuit can also handle ½-in. to 36 mesh raw coal slack with the sinks from the separator if necessary.

eliminates the possibilities of cleaning the fine coals (below ¼ or ⅙ in.). As far as the coking coals of India are concerned, these fines give high yields of clean coal with production of few rejects and/or middlings, owing to concentration of the brights which are of low ash content and which, due to their high degree of friability, tend to segregate in the fine sizes.

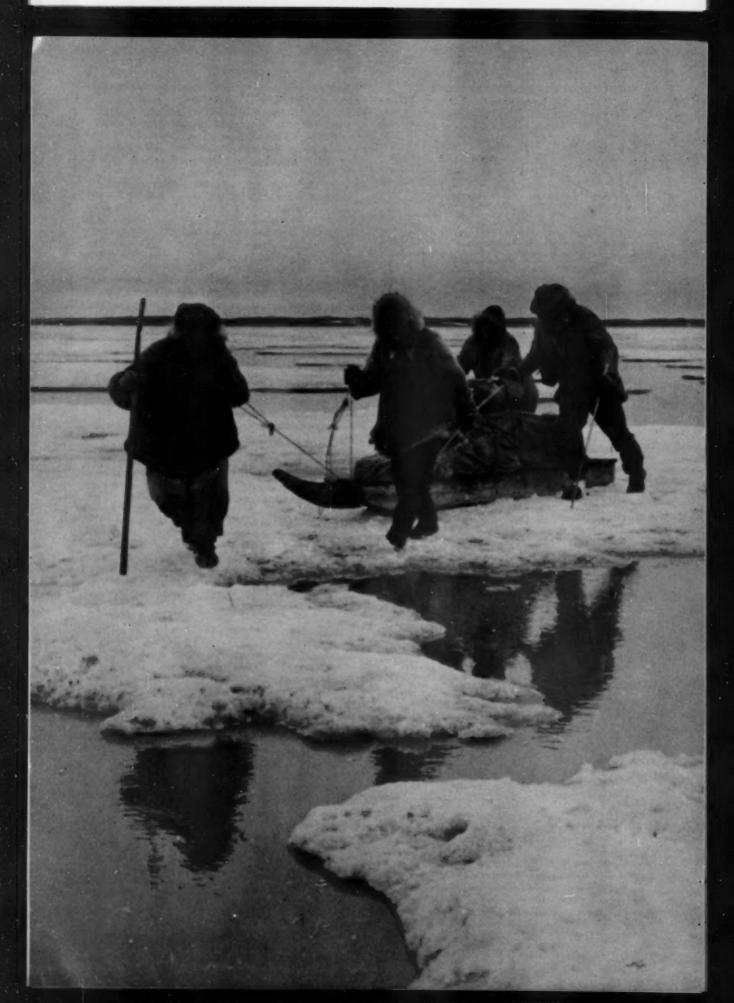
As already stated, the solution lies in employing the "composite washing" system, comprised of heavymedia units for 3 in. to 1 in., 3 in. to ½ in., or 3 in. to ¼ in. size fractions and Baum jigs, feldspar jigs or cyclone washers for the slack sizes below 1 in., ½ in. or ¼ in. depending on the quality of the feed. It may often be necessary to interpose Baum jigs for the removal of obvious dirt from 3 in. to coal and delivering a consistent and pre-wetted feed to the secondary washer where the final separation of cleans from middlings is to be made. This is particularly important when supplies have to be drawn from a number of small sources producing coals of indifferent quality and consistency.

The practice of interposing a pre-washer (operating at higher density) before the final washer (operating at lower density) has been adopted with advantage in a large number of installations around the world. The application of the double washing technique merits special consideration in dealing with difficult coal washing problems in India, involving treatment of a wide and uncertain fluctuation in the nature and supply of raw coal. Flowsheets of three large central washeries now being constructed in the Jharia coalfield, approximately 100 miles northwest of Calcutta, are shown on this and the opposite page.

# CONCLUSION

The decision to install multi-unit and multipurpose central washeries in India was made after detailed studies and thorough survey of the cleaning characteristics of the Indian coal resources with statistical analyses of washability data and a critical study of the performance and limitations of conventional coal cleaning plants. In drawing up the washing schemes and specifications, every effort has been made to judge each specific problem on its own merits. In view of depleted reserves of comparatively good quality coals, more and more inferior quality seams will have to be worked in future to meet the increasing demands of washed coal for the new iron and steel plants to be set up in the subsequent plan periods. This will invariably call for crushing of coals to below 1/2 in. or even smaller prior to washing for obtaining reasonable yields of clean coal. In such cases, completely different types of washing schemes will have to be adopted necessitating the incorporation of more elaborate systems for slurry treatment and arrangements for dewatering and drying of the washed products.

The Central Fuel Research Institute of India is actively engaged in studying the preparation of Indian coals and the problems associated with it. They have been entrusted by the Government with the responsibility of studying the washability characteristics of coal to be fed to these washeries, interpreting results, drawing up plans and specifications, scrutinizing global tenders, and conducting guarantee and performance tests for the projected washeries.



# MINING IN THE ARCTIC

# THE FUTURE PROSPECT BRIGHTENS

by PAUL E. QUENEAU

This study confines itself to an examination of the two million square miles of the northern hemisphere which the geographer defines as the terrestrial Arctic, a land region in which the mean temperature of the warmest month is below 50°F—in effect, the area lying north of the tree line. The engineering and human problems there are of a different order of magnitude than is generally true of the sub-Arctic. Whether in Dawson Creek or Matanuska, in Mo i Rana or Skelleftea such problems are of the same general order as in Hibbing or Noranda. The same is not true in Kong Oscar's Fjord or Lancaster Sound.

The sparse life of the Arctic is dominated by the long, cold winters; the summers are too short and cool to permit plant growth in the barren soil other than a scant cover of grasses, lichens, mosses, and a few stunted shrubs. The human population, as well as the fur-bearing and other native animal population of the land, is of low density. Significant economic activity based on agriculture or forestry is impossible. So far as marine fauna are concerned, commercial fishing is unattractive in the poorly productive waters of the Arctic zone except where they mix with warmer waters from the south, as off the Lofotens, Iceland, and southern Greenland. Thus for many years in this remote section of the globe, it is not on land or sea that man will reap any rich harvest. It is the Arctic's great non-renewable resources that are present, in the bowels of its frozen earth, which will be increasingly utilized during the coming decades.

Enumeration of the existing mining operations in the North American Arctic requires little effort. In the United States there is sporadic placer gold mining in the river system which flows into Kotzebue Sound from the western Brooks Range of Alaska, and coal is mined occasionally on Cape Lisburne and on the Meade River. An accumulation of oil north of the Brooks Range in the 37,000 sq mile Naval Petroleum Reserve will someday be brought into production. An exploration program conducted at a cost of \$50,000,000 located several promising structures, the richest of which is believed to be the Umiat field. 180

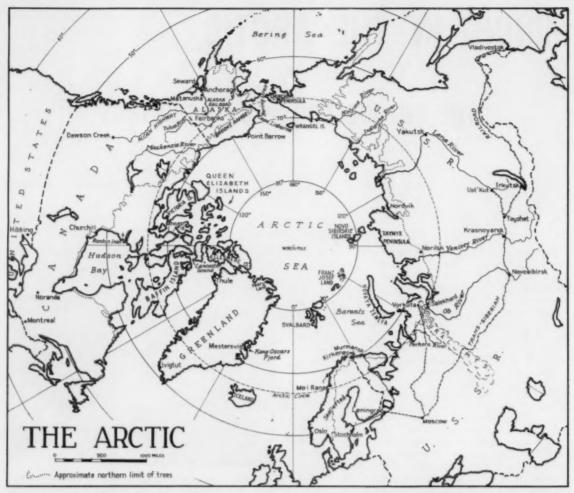


In Alaska, the Naval Petroleum Reserve exploration program (1944 to 1953) was an important step in evaluating our Arctic resources. Above, supplies being unloaded on Alaska's Arctic coast. (Official U.S. Navy photograph.)

miles southeast of Point Barrow, with an estimated 70,000,000 barrels of recoverable reserves. A modest nickel-copper deposit is being exploited at Rankin Inlet, north of Churchill, Manitoba on Hudson Bay, and it constitutes the only mineral production in the Canadian Arctic. Important quantities of petroleum may be present in the sediments of the Queen Elizabeth islands such as Bathurst Island, and substantial tonnages of iron minerals are known to occur in several areas including Baffin Island. In Greenland, there is a small cryolite mining operation on the southwest coast at Ivigtut and a small leadzinc mining operation at Mestersvig on the east coast.

For reasons which will be elaborated below, the mineral industry is notably more active in the Arctic of the eastern hemisphere. On the Barents Sea at Kirkenes, Norway where the coast is still influenced by the Gulf Stream, there is a major iron mining enterprise which has 1000 employees and exports a million tons of high grade concentrates yearly. Svalbard produces a considerable amount of coal by a Norwegian effort also involving 1000 persons. Presumably, the Soviets are also obtaining coal there from concessions which shelter a Russian population of perhaps 2500. The Norwegian mining operations are at Longyear City and New Aalesund and the Soviets are at Barentsburg, Grumant City,

PAUL QUENEAU is a Governor of the Arctic Institute of North America and has travelled extensively in the Arctic. This paper, originally entitled, "Utilization of the Arctic's Natural Resources," was presented at the Natick Conference on Man Living in the Arctic, December, 1960, sponsored by the National Academy of Sciences, National Research Council, Army Quartermaster Corps and the Arctic Institute.



and Pyramiden. The mining establishments were destroyed during World War II but have since been reconstructed and post-war Norwegian coal production has been running at about 500,000 tons per year. Also on the Barents Sea, near the ice-free port of Petsamo in a region ceded to the Soviets by Finland, there are important nickel-copper mining and smelting operations with a nickel output amounting to possibly 30,000,000 lbs yearly. Moving eastward toward the Urals, the Pechora Basin is a major producer of high quality coal and of oil and gas; present coal output is apparently approaching 20,000,000 tons yearly. The chief mining center is Vorkuta with a population of at least 50,000. The Salekhard region, just east of the Urals, is reportedly a producer of natural gas. Further eastward near the mouth of the Yenisey is Norilsk, believed to be the main Russian nickel producer with an output of perhaps 50,000,000 lbs yearly, and major concomitant copper, cobalt, and platinum metals output. One million tons yearly of coal and (reportedly) oil is produced in the vicinity of this city of 100,000 inhabitants and is by all odds the leading Arctic mining center of the world. There are a number of fuel sources of local significance eastward along the coast such as coal at Nordvik, near the delta of the Lena and at the mouth of the Indigirka. Tin and gold are mined in scattered localities in the coastal mountains of the Chukotskiy Range.

A great assistance to the development of the Arctic in the eastern hemisphere is the Gulf Stream and the presence of large rivers in Russia which flow northward into the Arctic Ocean, including the Pechora, Ob, Yenisey, Lena, and Kolyma-the middle three of which are among the longest in the world. These rivers constitute extremely valuable transportation links between the coast and Russian population and supply centers, since the Trans-Siberian Railroad crosses the upper reaches of the Ob and Yenisey and is close to the head waters of the Lena. The only comparable north-flowing river in the West is the Mackenzie. Another advantage in the East is that ice interference to summer shipping along the Arctic coast is much less than in the straits of the Canadian Archipelago.

# LOGISTICS, POWER, LIVING CONDITIONS: FORMIDABLE FOES IN THE ARCTIC

Consideration of the above mining operations immediately impresses one with a feature which they possess in common and without exception—location on tidewater or navigable river or short railway connection thereto. This is no accident and brings us to the main obstacle which must be overcome by industry in the Arctic—the high cost of logistics. The movement of material and personnel to and from the isolated Arctic mining operation constitutes an increment to the expense of production which places it at a distinct disadvantage in competition with mineral exploitation in more readily

accessible regions to the south. This is the great and all-pervasive deterrent to development of mineral resources in the far north. It multiplies the cost of initial exploration, of plant and townsite construction and operation, of utilities and inventory maintenance, of labor, and, inevitably, of the delivered product.

Transportation by water is lowest in cost per ton-mile, followed at present by rail, road, crosscountry tractor train, and fixed-wing aircraft. Some concept of the financial burden involved is indicated by the rate of \$200 per ton for coastal DEW Line station supply from Montreal. Bulk freight may move at 5¢ or less per ton-mile by rail as compared to around 10¢ per ton-mile by road. General cargo may move cross-country by tractor train or fixed-wing aircraft at 40¢ to \$1 per ton-mile, cost and choice of such transport being largely controlled by location and nature of the terrain and type of aircraft employable. The adverse effect of logistics on economy is magnified since heavy, rather than light, industry is involved. The cost of mine product shipment alone can easily exceed its market value.

Another difficulty mitigating against Arctic operations is one which might be termed the heat balance in its broad sense. Energy for machine propulsion or endothermic process reaction is costly, with few exceptions, since it usually must be generated locally on a small scale with expensive fossil fuel. In addition, the severe climate necessitates large expenditures for direct-heating purposes. The adverse heat balance can amount to a competitive penalty of several dollars per ton mined. Hydroelectric power potential is limited and its transmission expensive; uneven water flow, ice, and permafrost are complicating factors. The wind is an inexhaustible supply of energy which requires no transportation; but its force fluctuates widely and accumulation of any large power capacity from this source is uneconomic. Solar energy, although of great magnitude, is extremely variable in delivery and low in density per unit area so large power capacity requires undue investment in collecting surface.



On Devon Island, the Arctic Institute is conducting studies in geology, glaciology, oceanography, and meteorology. Above, Dundas Harbour. (Courtesy of Geographical Branch, Dept. of Mines & Technical Surveys, Ottawa.)



Independence Fjord (Greenland) in May. Cliffs are 2500 ft high, and mounds (lower right) are very large icebergs.

Omnipresent permafrost, the zone in the ground perennially below freezing point, is troublesome in the construction of buildings, utilities, and waste disposal. Costly measures are frequently necessary to avoid disturbing the thermal regime with resulting settlement, caused by melting of ice in volume exceeding the void content of the thawed, consolidated soil. Large quantities of gravel, often hard to obtain, are essential for surfacing and foundations. Permafrost does not interfere seriously with underground mining and is basically an aid to road construction. However, its few feet of active top layer and the poor drainage can create virtually impassable conditions for vehicles during the summer months.

Last but not least of the innate impediments of the environment is the problem of manpower. The widely scattered circumpolar aboriginal population, including Eskimos, Lapps, Samoyeds and Chukchis, total only 100,000. Thus any major mining enterprise requires importing a labor force unaccustomed to the rigorous living conditions and probably reluctant to settle in the area. It is not only the windchill and the lack of urban amenities which the immigrant finds repellent-the long periods in which the sun doesn't rise or is hidden by fog or low overcast and the paucity of fauna and flora exert a depressing effect leading to discontent. This is a problem which does not lend itself to any ready solution. Compulsion can be employed as in the Soviet Empire, e.g., the penal colonies for useful liquidation of political prisoners which played so prominent a role in the establishment of Vorkuta and Norilsk or the forced transplanting of national groups to Siberia. However, even a political system based on military social discipline and profligate consumption of "human material" has proven inadequate to the task. Currently, special financial rewards and vacation privileges are offered to induce voluntary migration of labor to the far north, as practiced in the West.

When all required expenditures are totalled, mine capital investment and operating costs in the Arctic can prove to be more than double those in less remote and harsh climes. The reader may now have concluded that the growth prospects of a rational mining industry there in the foreseeable future are



Bleakness of the Arctic coast near Petsamo (Pechango) USSR, belies important nickel-copper operations nearby.

cold indeed. This is not necessarily the case due to world population pressure and the meteoric progress of science and engineering which, properly harnessed, can provide capabilities which not long ago would have been considered fantastic.

### OVERCOMING ADVERSE CONDITIONS

This discussion avoids flights of fancy such as the recent publicized scheme for damming the Bering Strait which would more likely end in disaster than triumph. It also omits carefully considered but complex projects on the order of the proposed port-creating nuclear blasts on the northwest coast of Alaska. However, tremendous advances have been made which are transforming the present bleak situation in respect to logistics, heat balance, and living conditions in the Arctic. How soon the new potential will become dynamic on a large scale depends in good measure on the wind of change blowing in lands closer to the Equator. The supranational, immutable law of relative energy input per unit of output which made the Czar of old build the epic Trans-Siberian Railroad in the south has made the Czar of today concentrate heavy industry in the same imperial marches. Since the Russians possess more natural resources than any other nation on earth, and the bulk of these are south of the tree line, there is today limited economic incentive for strong industrial development in Arctic Siberia. If the Atlantic Community has adequate access to minerals from areas to the south, on the basis of fair and mutually profitable exchange, then intensive Arctic mineral development will be relegated to another generation. The engineer knows that, if political circumstances permit, the enormous reserves of mineral wealth lying between the Tropics of Cancer and Capricorn can economically dominate those lying north of the Arctic Circle. It must nevertheless be understood that man's ability to take rewarding industrial action in

the far north will in ten years be very different than it is today.

The cost of transport by air freighter is inverse to the lift capacity and efficiency of the vehicle, and here the jet engine is one of the Arctic's best friends. A projected Lockheed turbofan jet cargo plane will move 40 tons of payload 2500 miles at 500 knots for less than 20¢ per ton-mile in Arctic service. VSTOL aircraft ("vertical short take-off and landing") will permit aerial truck and bus drivers to take off and land vertically yet travel with fixed-wing aircraft speed and range, allowing large savings in ground facilities. There is also promise in the "hovercraft," a ground effect vehicle which rides a cushion of air a few feet above land or water. It may in due course play a role in freeing light transport from direct contact with the earth where, as in the Arctic, long distances may be travelled over reasonably flat topography. Much improved bulk cargo cross-country locomotion, such as by huge amphibious track-laying vehicles designed for tundra and rock desert use, is already within our grasp. The blue water monopoly exercised by the ice canopy in the High Arctic has now been broken by the submarine, so that traditional heavy transport by water will in time sharply extend its domain.

The advent of nuclear energy has metamorphosed the heat balance problem in the Arctic beyond recognition. Within a decade it will be possible for a major Arctic operation to generate steam and electric power at costs similar to those common in many industrial nations of the temperate zone. Removal of the heat balance handicap can in turn lead, in the case of a number of elements at least, to elimination of the high cost of moving large tonnages of relatively low grade mine product to market. For instance, raw ore or concentrate could be subjected locally to a choice of pyrometallurgical, hydrometallurgical or vapometallurgical techniques and thereby



Only lead-zinc operation in the Arctic is at Mestersvig, Greenland. Both mine and concentrator are underground.

allow the export of practicable tonnages of high grade metal.

In so far as questions of permafrost and personnel are concerned, it is now possible to conduct operations underground and, in the Arctic at least, at lower cost and with greater ease than on the surface. Air-conditioning, television, sun-lamps, and hydroponics allow man to build vast, modern sub-surface igloos in rock, almost independent of the world above. The wind and snow, chilling, sporadically demonic, building concretelike drifts and sifting through nook and cranny, can be ignored. Selection of employees, good food and private living accommodations, generous public recreation facilities, and adequate vacations will minimize the manpower problem.

# PRESENT NECESSITIES PROVIDE FUTURE AVENUES OF DEVELOPMENT

It is interesting to note that it is the sword which is cutting down the barriers to peaceful pursuits all around the polar Mediterranean. Following in the paths of the Anglo-American military explorers of yesteryear who journeyed into the white solitudes until the Pole was attained, North American defense forces are creating new and favorable circumstances for man living in the Arctic. The list of these military contributions is long and impressive: the longrange jet plane and heavy-duty helicopter; the submarine and the icebreaker; special track-laying vehicles; Alaska Railroad; Alcan and other highways; the DEW Line, White Alice, and Thule communications networks; meteorological stations; navigation aids; airfields and harbors; lubricants, water and sanitation facilities; nuclear power plants; permafrost management and use of snow and ice as materials of construction; medical advances; and improvements in cold weather clothing.

Most of the far northern USSR is forbidden to

foreigners but there is no doubt as to the outstanding record of achievement there. In war and peace the Russians, from the Cossack conquerors of Siberia to Ivan Papanin and his co-workers, have long and successfully struggled with their cold weather environment. The remarkable efforts expended along the Northern Sea Route have always had a military purpose, quite aside from provision of reliable deepwater transport for economic development. The history of Rozhdestvenski's encounter with Togo might have been different if his route had been less than half as long: via the Taymyr Peninsula rather than the Cape of Good Hope. Ironically, the first warship to complete the Northeast Passage in one navigating season was the German raider Komet during the Hitler-Stalin Alliance. The ice-free port of Murmansk and the Pechora coalfields were linked to the interior by railroads built in World War I and World War II respectively. Since then an immense investment has been made along the entire littoral to aid and control sea-air traffic and to establish an Arctic air-theater; typified by the atomic icebreaker Lenin, hundreds of air strips and radar posts, weather and sea-ice forecast stations and geophysical observatories.

It will be remembered that the superb roads built for the Roman legions became peaceful avenues of commerce for centuries and the same will eventuate at the top of the world. Spectacular achievement in the utilization of the Arctic's natural resources will not be accomplished in the polar summer-long day. The giant efforts involved can only be on a national scale, as exemplified by the intimate association between private enterprise and public interest which is responsible for this continent's magnificent telephone system. The destiny of those countries with horizons in the big sky of the high latitudes is tied to the steadfast North Star, and it must be their guide.



In grizzly drifts, slusher drifts, development headings

# CONCRETING REMAINS THE ANSWER FOR GROUND SUPPORT AT THE KELLEY

by ROBERT P. CORBETT

Since the beginning of operations at the Kelley mine in 1952, Anaconda has emplaced more than 150,000 cu yd of concrete underground. Concreting practices have changed over the years but the net result is still the same—lower costs along the line and more versatility.

Butte district operations of The Anaconda Co. represent a long history of mining activity and metal production. The finding of gold along Silver Bow Creek in 1864 marked the beginning of a production of mineral wealth unusual for any single mining district in the world. In nearly a hundred years of mining, the district has produced about fifteen and one-half billion pounds of copper, nearly five billion pounds of zinc, as well as appreciable quantities of lead, manganese, silver, and gold.

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This metal was produced by underground vein mining methods extending from surface to depths presently exceeding 5000 ft. From geologic evidence and records accumulated over the years of veintype mining, the existence of a large, low-grade area in the central and eastern section of the district became evident. Since this material was not economically recoverable by conventional selective methods of mining, a decision was reached in the late 1940's to extract the ore from this area by block caving.

Consequently, development of The Anaconda Co.'s new Kelley mine was initiated in 1947 and first

production of ore was achieved by April 1952. Of interest is the fact that further exploratory work, carried out in the eastern part of the district to delimit Kelley cave-ore reserves, led to the discovery of another large mineralized area of such grade as to be unminable by block-caving methods, but from which the low-grade material could be profitably mined by open pit. It is in this latter area where the Berkeley Pit is situated and from which initial production began in October 1955. Thus, it can be realized that the Butte district finds itself in the unique position of being one of the few mining districts in the world where ore is being produced simultaneously by underground selective, block-caving, and open pit methods of mining.

### PREPARING KELLEY OPERATIONS

Because the Kelley orebodies are comprised of previously-mined vein areas with resulting timber and gob, and because of the presence of sealed-off but dormant fire areas in various parts of the orebody, an intensive program of fire elimination and prevention, together with ground stabilization, was necessary to prepare for caving operations. Mill tailings, about 50 pct solids, were placed hydraulically from surface plants via pipeline and introduced into the old workings to be filled. In order to confine these tailings to the desired areas, nearly 700 concrete bulkheads had to be constructed in the various mine openings involved. Working through the many available shafts in the district, over seven million tons of tailings were placed under pressure as part of the fire-filling program. Concurrent with this program, Kelley shaft and level development was carried out and the work so scheduled that completion would coincide, thus permitting production to begin at the earliest possible date.

The Kelley mine is served by two vertical shafts, the Kelley No. 1 main shaft for rock hoisting, and the No. 2, which is situated nearby, for the service of men and supplies. Both shafts are presently bottomed on the 3000-ft level. Except for a short section near the surface in the No. 1 shaft, both were extended to depth by raising in successive lifts varying from 350 to 700 ft in length.

### EARLY CONCRETING PROGRAM

The first major or large-scale use of concrete for permanent ground support in the district was the placing of concrete linings in these two shafts. Since considerable concrete was required for the placing of the fire-filling bulkheads previously mentioned, and in anticipation of the No. 1 and No. 2 shaft concrete work, a central concrete batching plant was constructed with a capacity of 200 cu yd per day. Presently, seven 3½-cu yd capacity transitmix trucks work in conjunction with this plant to serve the entire concrete needs of the district, both surface and underground.

The Kelley No. 1 man-hoisting shaft, one of the largest in the Western United States, has a 38 x 10-ft rock section and is about 35 x 10 ft inside the four-compartment concrete lining. The large fourth compartment was subsequently divided into two additional hoisting compartments by steel dividers.

The lining was emplaced by first removing several complete floors of shaft timber at a selected distance below the collar, installing steel forms, and concreting upwards in 300-ft lifts, removing the remaining shaft sets, floor by floor, as the work

progressed. Each successive lift was concreted in the shaft section immediately below that just completed. Three complete 5-ft sections of forms were employed, and upon the completion of the first 15 ft of concrete lining, the bottom-most form was retracted, raised through the two remaining forms, and positioned for the next pour. Eight hundred pounds of reinforcing steel in prefabricated sections were installed in each foot of shaft. Concrete delivery, averaging 7½ cu yd per linear foot of shaft, was made possible through a 6-in. line in the shaft extending from the surface in the manway compartment.

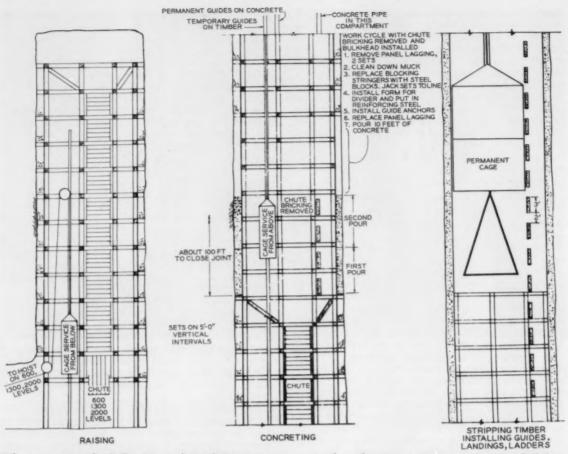
Concreting in the Kelley No. 2 service shaft was accomplished somewhat differently in that the concrete was placed by utilizing the shaft raise sets for forming after the raising operation had been completed. As soon as the entire length of the shaft had been concreted, the timber sets, panel lagging, etc., were stripped, leaving the finished shaft ready for guiding and equipping. This service shaft is one-half the size of the main shaft and is divided into a 14 x 7-ft cage compartment and a 3 x 7-ft counterbalance compartment.

Owing to their comparatively large size, off-shaft excavations such as level stations, loading pockets, overflow pockets, and ring dams, have been given permanent reinforced concrete support after having been excavated with temporary timber support designed to adapt itself to the subsequent forming operation. Being immediately adjacent to the shaft, such areas were readily poured from the shaft concrete line.

The ore-producing zones are situated from 3000 to 5000 ft easterly from the shaft and are served by haulageways equipped with 36-in. gauge trolley-operated equipment, consisting of 12-ton locomotives and 115-cu ft capacity Granby-type cars. The main tramming levels are at 600, 1300, 1600 and 2000 ft, with several intermediate levels whose production is routed through transfer raises to the main tramming levels.



Pre-mixed cement is transported to underground haulage levels through vertical shaft lines or drill holes.



When concreting the Kelley No. 2 shaft, shaft raise sets were used as the concrete forms after raising had been completed. Once the concrete had set, the shaft was stripped and made ready for guiding and equipping.

About 12 pct of the total ore estimate is made up of back-filled stopes of various sizes and ages, together with abandoned raise and sill openings. Many of the mining blocks consist of over 50 pct of this type of material. Consequently, because of the unusual character of the ore (damp, sticky, presence of mill tailings, and old gob timber), many orehandling problems are presented. Ground strength is low in the zone mining areas, and all development openings require support.

The Kelley mine was originally planned and brought into production on a grizzly level-gravity system of block development, patterned generally after Southwest block-caving practices. Shortly after the initial production was started, severe weight conditions were encountered in the timbersupported grizzly drift openings. This condition persisted throughout the mine, and by the time production had risen to the planned output of 10,000 tpd, excessive repair costs were experienced in maintaining the timber support of these openings. In addition, the crushing and impairment of the openings had a serious effect on working conditions, ore-drawing distribution and control, and on the overall morale and efficiency of Kelley mine production crews.

In order to combat the weight problem, several changes in the design and type of grizzly level support, together with changes in block layout and mining sequence were made, but high repair costs continued to present a serious operational problem.

Early in 1953, concrete support of several grizzly drifts was tried in a particularly troublesome area in one of the upper level zones. Results were so manifest that decision was reached to extend this type of support throughout the mine as rapidly as possible. Obviously, this decision was made somewhat easier because of the existence of a batching plant and transit-mix truck fleet already available and in operation, ready for use, thus eliminating the need for a large cash outlay necessary to mount a concrete-support program.

Over the next three years, more than 25,000 linear feet of block-development openings were concreted on the grizzly level horizon, resulting in a remarkable reduction in maintenance costs and improvement in working conditions. The grizzly level support consisted of massive concrete poured against the ground opening on the outside and 6½ x 4-ft elliptical arch sectional wooden forms on the inside, with suitable openings left periodically for the finger raise draw points. No reinforcing was used. Original wall thickness was approximately 12 in., but this was subsequently increased to a minimum of 18 in.

Encouraged by the stability and effectiveness of the concrete support on the grizzly level, and in order to more effectively cope with loading problems attendant to the handling of damp, sticky ore through the gravity main raise system, a changeover was made to the grizzly control first floor slusher type block. Ultimately, the basic block design was changed one step further—the grizzly level, together with the inclined slusher raises, was eliminated and replaced by four concreted slusher drifts located on the first floor on a 30-ft center-to-center spacing. This latter layout is incorporated in present Kelley block development practice.

To date, more than 20,000 linear feet of slusher drift openings have been lined with concrete. Except for a wear beam at each draw point brow, massive unreinforced concrete of 24 in. minimum thickness is placed for support here also, using sectional wooden forms 8 ft high and 6 ft wide, and having a semicircular top. After the completion of concreting, including the floor with imbedded wear rails, lanes are equipped with 75-hp slushers, with 60-in folding scrapers. Four lanes are required for each 120 x 120-ft block.

### PRESENT CONCRETING METHODS

During the period from the beginning of production in 1952 through December 1960, the Kelley mine has produced over 25,000,000 tons or ore. During this same period, more than 150,000 cu yd of concrete have been placed underground. More than 70 pct of this amount has been used directly in zone mining ground support, while the remainder has been used for shafts, stations, pockets, ventilation, and transfer raise installations.

The emplacement of this volume of concrete has introduced the very specialized materials-handling problem of distributing the concrete in widely separated areas having a large horizontal and vertical extent and countercurrent to the normal flow of ore production. The handling problem can be divided into three main parts:

- 1) Transportation from the batching plant to the working level.
- 2) Lateral transportation on the working level to a concrete placer in the pour area.
- 3) The movement of the concrete via pipeline from the placer to discharge into the forms.



Prior to concreting, openings are temporarily supported with rock bolts or with light-weight rail or timber sets.



Once underground, the mix is hauled by rail to a placer (above) and then by pipeline to the area being concreted.

The transportation of the concrete from the plant to the working level is accomplished through the use of transit-mix trucks that discharge directly into a vertical, heavy-duty Victaulic-coupled shaft line when pouring shafts, stations, and pockets, or through churn drill holes cased with 6-in. pipe for zone-mining use. Both connect to the haulage system underground.

Recently, a 6-in. rotary hole was drilled adjacent to the No. 2 shaft from surface to both the 600 and 1300 levels. Since this hole is uncased, it cost less than an equivalent shaft line and eliminates the problem of maintaining a concrete distribution line in an operating shaft. Concrete access holes have varied in length from 631 to 1551 ft, and several have passed 25,000 cu yd or more of concrete with no difficulty.

The second part of the handling problem, that of lateral level transportation, is coped with by allowing the concrete to discharge from the shaft or bore hole lines directly into the 115-cu ft Granby-type haulage cars for transportation over the regular mine haulage system. The length of rail haul varies from 1500 to as much as 5000 ft. In one instance, it was possible to position the bore hole so as to permit discharge directly into the placer for lateral distribution by pipeline.

The last phase of the problem of handling, and the most important, is the actual placing itself. The concrete laden haulage cars are dumped by means of an air cylinder into a slusher trench adjacent to the track and the concrete is ramp-slushed into the top of a placer, by which it is moved via pipeline into the forms. The action of the scraper bucket in the trench insures adequate remixing, thereby eliminating any segregation that may have occurred during transit.

Placing by pipeline is accomplished by either of two methods: the Pumpcrete pump and pipeline system; or pneumatically, using the Pressweld or home-constructed placers. The Rex model 360 Pumpcrete machine is used, and it delivers a good quality of concrete at low velocity for distances of 800 to 1000 ft of effective line length, where 1 ft of vertical rise is equivalent to 8 ft of horizontal run.

The effective range of the pneumatic placer is much greater and pours have been made through lines over 2000 ft in length. Experience has shown



To date, more than 20,000 linear feet of slusher drifts have been lined with 24-in. thick (minimum) concrete.

that the tendency towards segregation, when placing pneumatically, increases as the length of the line increases and that quality of concrete comparable to pump and pipeline delivery can be achieved if the length of the discharge pipeline is held to a 400 or 500-ft maximum. As would be expected, because of the higher velocity the 6-in. heavy-duty pneumatic discharge line is subjected to much more abrasive wear than that experienced with the relatively light toggle-connected pumpcrete pipe. High discharge velocities further contribute to segregation by causing spattering and differential separation of the concrete ingredients. Shortening the length of the line as much as possible reduces the tendency of the line to plug.

A 6-sack-to-the-yard, ¾-in. maximum-size aggregate constitutes the normal concrete mix. This results in 3000-lb concrete, 28 days, using a slump of 4 to 5 in. Slump is critical, since, while concrete should be low in slump for maximum strength, a moderately high slump is required for trouble-free transport in pipelines and bore holes. Experimentation has been carried out with various additives aimed at improving the effectiveness of the concrete, and at the present time a pozzolan dispersion agent is being employed for the somewhat improved placeability that results. In both methods of placing, pouring rates average about 15 to 20 cu yd per hour.

Openings to be concreted are temporarily supported with rock bolts or light weight rail or timber sets, as ground conditions dictate. Fifeenfoot sections are concreted during each pouring cycle, using a three-man crew. After the end bulkhead is in place, 35 to 40 cu yd are poured. Wall and arch concrete thickness averages 2 to 3 ft. Pours completed on dayshift are stripped during the last

half of the nightshift. Because loading pressures by ground movement are uncontrollable, premature loading can occur before the concrete sets and ages properly, a situation quite different from that encountered in surface construction. Although cracks appear, and cracking and overriding of the arch is to be found quite commonly in areas of exceptional ground weight, the concrete continues to stand, effectively supporting the area.

## CONCRETE CUTS COSTS

During the period when concrete ground support was becoming firmly established in the mine, other methods of support continued to be tried on an experimental basis-support such as that afforded by yieldable arches, rigid circular steel sets, and 8-in. wide flange steel sets lagged with 10 x 10-in. timber. These support methods have been discarded either because of cost considerations, unadaptability to block design, mining conditions or outright failure to do the job. It is interesting to note that the price of cement has risen less over the years than any other construction material used underground. Since 1940, while timber supply costs have increased 126 pct and steel 130 pct, cement has risen only 57 pct. The other ingredients, rock, sand, and water, are locally available, and the cost in place is primarily dependent on the efficiency of the handling methods; hence within the control of the mine operator to a great extent.

In areas of exceptionally excessive weight, cracking, spalling, and arch overriding occur, but since the block sections remain effectively keyed together there is little or no interference to production. There have been some sections where complete failure has occurred, and repairs have been affected by repouring such sections. Substantial cost



Large excavations such as level stations have reinforced concrete support. Original timber sets served as forms.

reductions were achieved during the initial fouryear period of changeover from timber to concrete support in the Kelley cave mining blocks.

After caving had been initiated, the cost of block repairs (labor and supplies) dropped 76 pct. The increase in efficiency of production in ore drawing, loading, and tramming resulted in corresponding cost reductions of 33 pct and 17 pct respectively.

Since that time, with the 100 pct conversion of the mine to a slusher mining system made possible by concrete support of the horizontal development openings, zone repair costs have fallen to 87 pct of what they had been originally. Credit for these substantial improvements in the operation are shared by concrete support and changes in basic block design that concrete support made attractive to consider and adopt. As experience was gained in handling concrete and as placing techniques improved, important reductions in development cost have also been effected.

### PROS AND CONS OF USING CONCRETE

The overall results obtained with concrete in the Kelley mine are as follows:

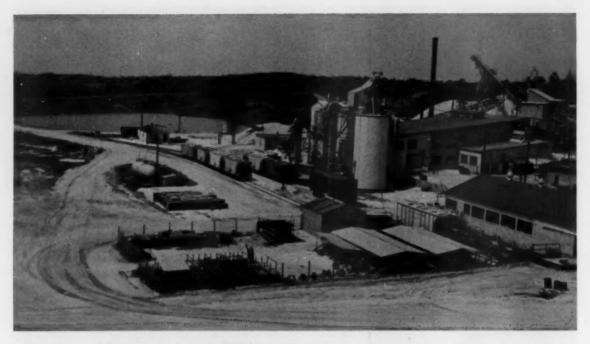
- Concrete support has made important cost reductions possible in repairs and increased efficiencies in mining production.
- 2) Concrete support provides working areas that are cleaner, safer, and better ventilated.
- Concrete support made feasible a change in block design from that of a gravity system to a 100 pct slusher system.
- 4) Because of its increased stability, concrete support has permitted the reduction in drawpoint area, which minimizes draw dilution caused by channeling and piping of the ore.

- 5) Concrete support permits maximum uninterrupted daily production per block unit. Good ore drawing control can be maintained, together with rapid extraction, since drawpoints are not stopped for repairs.
- 6) This method of support provides openings that continue to remain open after mining has been completed and which can be utilized for ventilation, expediting adjacent block development, and other useful purposes.
- 7) Concreted openings are fireproof—an item of special importance considering the presence of old timbered stopes in the Kelley ore zones.
- 8) In the deep ore zones, where caving takes place under abandoned blocks above, the debris from the caved concreted openings is less troublesome than that from timber and steel.

On the debit side of the ledger are the many and varied handling problems, the definite time limitation imposed when dealing with concrete, the need for specialized crews and supervision, unforseen delays, such as plugged lines or equipment breakdowns that usually result in the total loss of the concrete supply material, and the relatively high investment in bore holes, pipelines, and placing equipment.

At the present time, in addition to the Kelley development work, concrete is being used as a support lining in two major shaft-sinking projects now under way. In heavy fault areas, timber support (either 3- or 5-piece sets) has been made exceptionally more effective by filling the void behind the sets with concrete, thereby insuring stability.

In conclusion, experience to date with concrete has proven it to be an effective and versatile supply material for use in specialized ground-support problems in underground development and mining.



Concentrator at Kings Mountain where USBM is conducting research on .

# FLOTATION OF SPODUMENE-BERYL ORES

by JAMES S. BROWNING

The pegmatites of the Kings Mountain-Lincolnton, N. C., area constitute the largest known domestic reserve of beryl and spodumene. The reserve is estimated to contain 90 million tons of pegmatic material with 1,280,000 tons of recoverable Li<sub>2</sub>O (lithia) as spodumene. The pegmatites also contain 0.4 to 0.5 pct beryl disseminated throughout the orebodies. The pegmatites may contain a potential reserve of 240,000 tons beryl, equivalent to approximately 34,000 tons of BeO.

Different flotation methods for separating beryl from feldspar or quartz, or both, have been developed by various investigators. \*\*. \*\*. \*\*. \*\* On the other hand, published information is limited on concentration of spodumene-beryl ores. As the response of beryl and spodumene to flotation is essentially the same, a successful separation of the two minerals depends upon use of a selective depressant or a selective collector for one of the minerals.

Several years ago, the U.S. Bureau of Mines, recognizing the need for developing a large domestic supply of strategic beryl, undertook studies to de-

velop improved methods of recovering this mineral. Because of the low beryl content of the pegmatites, economic production of the beryl entails its recovery as a byproduct of spodumene flotation. Thus, the development of procedures that would provide for maximum recoveries of the spodumeme, as well as the beryl, was a primary objective of the studies. Tests were made on run-of-mine ore and spodumene flotation tailing from the Foote Mineral Co.'s spodumene concentrator at Kings Mountain. Petrographic analyses of the ore and flotation tailing are given in Table I.

Detailed analyses and examinations of the ore and tailings revealed that the beryllium was present in the form of a low-alkali beryl. The crystals were small, rarely larger than 14-mesh in diameter, and were clear and colorless.

About 10 pct of the Li<sub>2</sub>O content of the ore was present in the mica and feldspar components of the pegmatite. In some weathered ores the associated clays also contained small amounts of lithia. This is typical of pegmatites in the Kings Mountain area.

### LABORATORY TESTS

In the past, a vigorous chemical treatment of the spodumene surfaces with acid or caustic soda has

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been considered essential for satisfactory selective flotation of the spodumene from the other minerals in pegmatites. Many tests were made during this investigation to determine if chemical treatment of the spodumene could be eliminated in favor of a reagent combination that would depress the other minerals while selectively floating the spodumene. A simple reagent combination and process was developed that gave better spodumene recovery and grade of concentrate than the more elaborate acid or caustic treatment methods previously used.

The finely ground ore pulps were conditioned with either an ammonium, alkali, or alkaline earth lignin sulfonate and sodium fluoride, and the spodumene was floated and cleaned using oleic acid as the collector. The spodumene tailing was deslimed, conditioned with sulfuric acid and coco amine acetate, and floated to reject mica. The mica tailing was thickened and conditioned with hydrofluoric acid, then washed to remove the acid. The washed pulp was conditioned with sodium hydroxide for pH control, and the beryl was floated and cleaned with oleic acid as the collector. Table II summarizes the results of the laboratory test work.

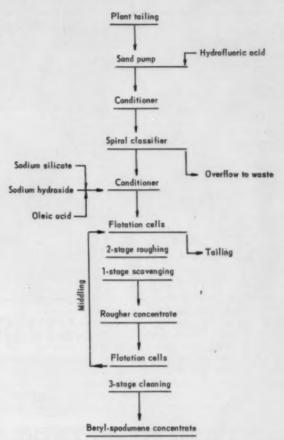
About 77 pct of the spodumene and 75 pct of the beryl were recovered from the pegmatitic material. The spodumene concentrate assayed 6.1 pct Li<sub>2</sub>O and 0.01 pct BeO, and the beryl product assayed 3.0 pct Li<sub>2</sub>O and 1.57 pct BeO. Similar results were obtained in tests of four other pegmatites, two from other deposits in North Carolina, one from Hill City, S. D., and another from Val d'Or, Quebec.

# PILOT PLANT TESTS

Spodumene Flotation: The laboratory investigation was promising enough to warrant further testing of the spodumene flotation step of the process in a small continuous flotation pilot plant with a capacity of about 150 lbs of dry feed per hour. The ore was crushed to minus 1/4 in., then wet ground continuously in a rod mill operating in closed circuit with a rake classifier to overflow minus 48mesh material. The classifier overflow pulp was fed to a hydroseparator to remove clay and thicken the pulp to 40 to 45 pct solids. The hydroseparator underflow as conditioned with 2 lbs of sodium fluoride and 2 lbs of lignin sulfonate per ton of ore. The discharge from the first conditioner flowed to a second conditioner, where 0.96 lb of oleic acid per ton of ore was added as the spodumene collector. The pulp then was floated to recover a spodumene concentrate. The tailing from the rougher cells flowed to a single cell, operated as a scavenger, to remove additional spodumene from the floating tailing. The froth from this unit was recycled through the last rougher cell. The rougher concentrate flowed to a bank of flotation cells for three-stage cleaning. Results of the continuous test are summarized in Table III.

The cleaner concentrate assayed 6.0 pct Li<sub>2</sub>O and accounted for a Li<sub>2</sub> recovery of 75.5 pct. The concentrate contained 83 pct spodumene by petrographic analysis, representing a spodumene recovery of 88.8 pct. About 11 pct of the lithia in the ore was not present as spodumene but was associated with the mica, feldspar, and clay.

Beryl Flotation: Small-scale continuous tests were also made to substantiate the laboratory test results obtained on beryl flotation. Rather than treat the crude ore to remove the spodumene before the beryl flotation, tests were made of spodumene tailings being produced at Foote Co.'s spodumene concentrator.



USBM process to recover beryl-spodumene concentrates.

As the plant tailing contained unrecovered spodumene, the purpose of the tests was to recover the beryl and spodumene together as a bulk concentrate that could be re-treated to produce enriched beryl and spodumene products. This method was attractive because it would enable recovery of additional spodumene from the pegmatite to pay part of the retreatment cost.

A part of the concentrator tailing, containing about 150 lbs of dry feed per hour, was diverted to the pilot plant. The pulp was conditioned with 2 lbs of hydrofluoric acid per ton of dry feed for five minutes at a pH of 3.8. The conditioned pulp was then washed in a spiral classifier to give a sand product for flotation and remove the acid from the pulp. The washed sands were admixed with water to produce a pulp containing about 30 pct solids in the slurry; and then they were conditioned with 0.9 lb of sodium silicate, 0.3 lb of sodium hydroxide, and 0.9 lb of oleic acid per ton of dry solids. The pH of the pulp was 7.3.

Table I. Petrographic Analysis of Ore and Flotation Tailing From Foote Mineral Co.

Analysis, Pet			
Ore	Tailing		
18.0	4.5		
	4.5 0.5 6.0 38.5		
32.5 43.5	38.5 50.4		
0.6	0.1		
	0re 18.0 0.4 5.0 32.5 43.5		

Table II. Laboratory Flotation of Spodumene, Mica, and Beryl

	Watehi		Analysis, Pet		Distribution, Pet		
Product	Pet.	Li <sub>2</sub> O	BeO	Mica	Li <sub>2</sub> O	BeO	Mica
Spodumene concentrate Mica concentrate Beryl concentrate Beryl middling Tailing	19.2 6.0 2.3 0.9 71.6	6.1 0.9 3.0 0.6 0.3	0.01 0.01 1.57 0.28 0.01	0.4 94.5 2.0 1.0 0.8	77.4 3.6 4.5 0.3 14.2	3.9 , 1.3 74.9 5.2 14.7	.2 89.0 0.7 0.1 9.0
Composite	100.0	1.51	0.05	6.4	100.0	100.0	100.0

Pounds per ton of ore

		8	Spodumen	•			Mica			Beryi		
	Conditioner			Cleaner		Cond	itioner	Cleaner	Cond	itioner	Clea	ner
	Ist	2nd	1st	2nd	3rd	1st	2nd	Ist	Int	2nd	1st	2nd
Lignin sulfonate	2.0	-	-		-	_		-	-	_	-	_
Sodium fluoride	2.0	1000	-	- married	-	-	-	-	_	and the same of	_	-
Oleic acid	_	0.96	-	-	-	decree.		Acres .	Service .	0.8	_	-
Sulfuric acid	_	-	-	****	-	2.0	****	-	-	_	_	-
Coco amine acetate	-	680000	-	min o	Giáne.	40000	0.16	-	-	-	-	-
Hydrofluoric acid	- ARREST	-	-	-	-	-	Married .	-	2.0	Married Street, Street	-	-
Sodium hydroxide	_	-	-				-	-	-	0.2	_	-
Conditioning time, min	5	5	-	-	and the same of th	3	1	MINNES.	5	3+5	-	-
Pulp pH	-	9.6	-	_	-		3.6	-	2.0	7.6	_	-

The pulp was floated to produce a rougher concentrate which was then triple-cleaned. The middling product was returned countercurrently to the rougher cells. The beryl concentrate assayed 1.25 pct BeO and 4.45 pct Li2O; about 87 pct of the beryllium and 66 pct of the lithia was recovered. The bulk concentrate also contained about 12.5 pct mica. 10.5 pct feldspar, and 5.5 pct quartz. A simplified flowsheet for recovery of the bulk beryl-spodumene concentrate is shown on page 707.

Batch Treatment: Because of the difficulty of producing enough bulk spodumene-beryl concentrate from the low-grade tailings for further continuous cleaning tests, the recovery of enriched beryl and spodumene products was carried out by batch retreatment consisting of three stages, as follows: 1) rejection of the mica, 2) flotation of the spodumene, and 3) flotation of the beryl.

The bulk beryl-spodumene concentrate was conditioned with 10 lbs of sulfuric acid per ton of dry feed to remove the fatty acid collector from the mineral surfaces. After washing the pulp to remove the fatty acid, it was conditioned with 2 lbs of sulfuric acid and 0.2 lb of coco amine acetate, then floated to reject the mica. The mica concentrate contained about 94 pct mica. Quartz, spodumene, and beryl, in the order named, were the principal contaminants in the mica concentrate.

The mica tailings were conditioned with 1.5 lbs of magnesium lignin sulfonate, 1.5 lbs of sodium fluoride, and 0.8 lb of oleic acid per ton of feed. The spodumene was then floated and cleaned twice. The concentrate assayed 6.6 pct Li<sub>2</sub>O and represented an overall recovery of 84 pct of the lithia in bulk concentrate. About 80 pct of the beryl was retarded in

The spodumene tailings and middlings were combined and conditioned with 2 lbs of hydrofluoric acid per ton of bulk concentrate. Then the acid was washed from the pulp, and the product was con ditioned with 0.3 lb of sodium hydroxide and 0.48 lb of oleic acid per ton of feed. A beryl rougher concentrate was floated at a pH of about 7 and cleaned twice. The resulting concentrate contained 6.37 pct BeO and 2.57 pct Li<sub>2</sub>O, accounting for a beryl recovery of 76 pct. The overall recovery of beryllium from the spodumene plant tailings was about 66 pct. The results of the tests of the bulk concentrate are summarized in Table IV.

The USBM has built a 2-tph pilot plant at Kings Mountain and is continuing its program on beryl recovery. Final results and milling cost studies will be available when these tests end.

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Table III. Summarized Results of a Small-Scale Continuous Spodumene Flotation Test

		Analysis, Pet Distribution, Pe				tion, Pet	
Product	Weight, Pct	Li <sub>2</sub> O	BeO	Spodu		BeO	Spodu- mene
Spodumene con-							
centrate	20.5	6.00	0.01	83.0	75.5	5.1	88.8
Flotation tailing Hydro-separator	71.9	0.44	0.05	3.0	19.4	89.2	11.2
overflow	7.6	1.10	0.03	trace	5.1	5.7	entire
Composite	100.0	1.62	0.04	19.1	100.0	100.0	100.0

Table IV. Flotation of Mica, Spodumene, and Beryl From Bulk Concentrate

	Weight.	Analysis, Pet			Distribution, Per			
Product	Pet	Ligo	BeO	Mica	Li <sub>2</sub> O	BeO	Mica	
Mica concentrate Spodumene con-	13.1	1.89	0.28	94.5	5.6	3.3	94.2	
centrate Beryl concentrate	55.7 13.2	6.60	0.33	0.5	83.6	16.7 76.1	2.0	
Tailing	18.0	0.76	0.24	1.0	3.1	3.9	1.4	
Composite	100.0	4.40	1.10	13.1	100.0	100.0	100.0	

**CONFLICTING INTERESTS** 

IN THE EXPLOITATION

OF INDUSTRIAL MINERALS

# WHY THE CONFLICT . . . A GENERAL VIEW

by ORRIS C. HERFINDAHL

What is a conflict, as it is understood by men of the extractive industries? And what are the circumstances out of which these conflicts arise? A start can be made with the notion of economic conflict, which can be defined as rivalry over the use of economic resources. Such rivalry is a central part of all economizing activity. It is present within the individual, within the family, and within the business firm. In each of these units there are multiple goals competing for use of a limited income. And economic rivalry is present among individuals and firms who are competing with one another for use of the limited quantity of economic resources available to us as a society.

But most of us have only a slight awareness of this pervasive rivalry, or conflict, with other firms or other persons. The farmer has no feeling of economic rivalry with his neighbor across the road, and the same is true within and among many other economic groups. The reason for such apparent tranquility in the face of omnipresent rivalry over the use of resources is that the conflicts are resolved by an instrument that converts them into something generalized and impersonal. Instead of thinking that other individuals and businesses stand in the way of our economic wishes, as is in fact the case, we come to feel restrained by impersonal forces, namely, market prices coupled with the fact of limited income. In any particular case, we are restrained from buying another machine or another car by the fact that prices are "too high," given our limited income, to permit us to do so. But this relation between prices and income is, in fact, the way by which the rival demands of other economic units are effectively opposed to our demands and come to affect our actions. From the point of view of the individual economic unit, the price system fragmentizes rivalries and renders them impersonal in the very process of balancing and bringing to play against each other competing demands in all parts of the economic system. The price system is to be characterized as the outstanding instrument which is practically available to us for the orderly and mutually beneficial settlement of disputes over the uses to which available resources are to be put.

A strong sense of immediate conflict is present in the matters to be discussed here, however. Why is this so? What is their distinguishing characteristic? It lies precisely in the fact that these economic conflicts are not resolved through the price system but in other ways, the main method being the political process, broadly conceived. That is, these conflicts are resolved by a law or regulation that enjoins or prohibits, by a law that restrains or bounds action in some way, by the decision of a governmental administrator, with the actions prescribed or prohibited in these ways enforceable by a variety of means. The settlement of conflicts by the political process rather than by the market is neither chaotic nor necessarily very time consuming. But these settlements can hardly approach the automaticity of the market place in settling conflicts, and what is more to the point, there is often the possibility of obtaining a more advantageous settlement by trying to persuade a legislative body that the law or regulations should be changed. It is this possibility that gives these conflicts their peculiar flavor and interest.

The general economic circumstance giving rise to many of the conflicts under discussion today seems to be simple. It is the presence of a "significant" (the qualification cannot be omitted) real interdependence between the economic activities of different economic units, that is between businesses, households, or governmental units engaged in economic activity. The interdependence must be real rather than monetary. There is monetary interdependence among all economic units, but, generally speaking, this is not regarded as a sufficient reason for resort to political rather than market settlement of rivalry. It should be understood that real interdependence is broader than material interdependence. If your mining operation clutters up the landscape in an unattractive way, there is a real effect, although non-material, on the satisfaction of the individual (satisfaction being his truly "real" income) as he sits on his porch of an evening and contemplates the mess you have made.

The presence of real interdependence among economic units, that is, a situation in which the size of the output of one unit affects the output of another, implies that some of the costs or benefits associated with the productive activity of a firm are not included or reflected in the accounts of that firm. Thus a firm that pollutes a stream may have no immediate interest in the fact that this action increases the cost of water treatment for downstream users. Or, to take another example, the lumberman's economic interest will not cause him to take more than passing notice of the fact that his activity reduces the enjoyment from outdoor recreation of many individuals—assuming, of

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course, that he would be unable to collect a fee from these individuals if his lumbering operations were altered so as to favor their interests.

Clearly some of these external effects-i.e., costs imposed on other economic units by the production activity of some one firm-come to be eliminated by the market process inducing a reorganization of production in such a way as to reduce or mitigate the effect. If this is to happen, somebody must find it possible and profitable to either collect the cost of doing this from the beneficiaries or to pocket the gain from reducing the effect. This is not the point at which to discuss the whole panorama of cases involving external diseconomies, but it is important to note that where these effects are visited by a firm on people or business units who are not its customers, there is frequently little inducement for the firm to spend any money to reduce or mitigate the effect. Cases of this sort are an open invitation to direct regulation by government, of course. It is the content of these regulations that constitutes the substance of the conflicts mentioned in the following pages.

Another important group of conflicts involves assets owned by government, with the flow of the various services from these assets either used directly by the government or perhaps sold to private businesses or individuals. In some cases the asset is owned and "operated" by the government because external effects under private ownership would be so hard to deal with that private ownership and operation is judged to be infeasible. In other circumstances, the assets may be owned and administered by the government because the cost of privately organizing and performing the function in question (including the collection of fees) is judged to be too great, perhaps because of monopoly, uncertainty about the market, and so on. Of course many assets are owned by governmental units more or less as the result of circumstances which no longer have any substantial relevance to current administration of the assets.

But regardless of the reasons why an asset came into government ownership, this fact in and of itself is the source of many conflicts in the use of these assets, some of which are capable of yielding more than one service flow simultaneously. Insofar as conflicts over the use of these assets is of the ordinary economic variety and is settled through the use of a suitable market process such as competitive bidding, no particular problem need arise. But in many cases, external effects do arise from the private use of assets owned by the government, just as with privately owned assets. It is to be expected that legislative bodies will consider such effects in deciding, directly or indirectly through administrative officials, the conditions under which these assets are to be leased. The problems here are similar to those involved in the regulation of external effects associated with the use of privately

In other cases of government-owned assets, however, conflicts may arise, not because there are external effects present, but because government is trying to attain some goal that could not be attained if use of the asset were to be determined by a market procedure such as competitive bidding. In some cases it has been decided, perhaps because of some principle of supposed equity, to favor one class of users which otherwise would be outbid or which is thought to be unable to make its bid effective.

### INCREASE OF CONFLICTS FORECASTED

There are two fundamental factors which will have the effect of increasing both the number and the intensity of several different types of conflict. These changes are a more or less steady increase in population and in real income. As a result of the increase in population, mining enterprises whose activities impose unwanted burdens and costs on individuals and businesses will find an increasing number of protests. Even if the physical volume of mining activity were not to increase at all, an increasingly large number of persons will be present to experience any undesirable effects that accompany mining activity.

The increase in population and in real income work together to intensify the conflict problem in still other ways. They both play a part in increasing rival demands for services flowing from those assets also wanted for use by the minerals industries. Two examples are the demand for outdoor recreation and the demand for water. At the same time, both the increase in population and income will have the effect of intensifying the water pollution problem, the resolution of which will effect the minerals industries along with other water-using and water-polluting activities.

Urban oriented areas can grow at so rapid a rate that existing mineral operations are leap-frogged. This higher population density leads to demands for regulations to reduce unwanted effects. However, the practical effects of regulations on previously existing operations are to some extent limited by the privileged position usually given to them. But regulation, whether by zoning or otherwise, exerts its full effect on operations established at new locations, and these new locations may have to be considerably further from the urban center than were the old operations.

Unfortunately the information that is available to us on changes in population density and the detailed nature of land use in urban fringe areas is not very thorough. So far as density is concerned, for example, there are no data for small areas of constant size. There are some data, however, that confirm what all of us can see is happening, namely, that the urban oriented areas around cities are growing and becoming populated at a very rapid rate. An indication of what has been happening is provided by data showing the percentage change in urban population by area of residence in the continental United States from 1950 to 1959.

Population in the standard metropolitan areas (i.e., complete counties containing at least one city of 50,000 or more) has increased by 19 pct from 1950 to 1959, but most of this increase has taken place outside the central city; and, what is more, it appears that over one-half of this increase has been on the fringes of the metropolitan areas rather than in the satellite urban areas. Central city population increased only 2 pct. Urban population outside the central city (but still in the metropolitan area) increased by 25 pct, but the spectacular growth (117 pct) has been in the rural nonfarm population which is in the metropolitan area but not in any urban area.

Outside the standard metropolitan areas, urban population grew by 10 pct, but the growth in rural nonfarm population was far greater—43 pct. Nationwide rural farm population has declined 13 pct.

# SPREAD OF URBAN BOUNDARIES THREATENS NEARBY OPERATIONS

The increasing population (largely residential) of the fringes of urban areas means that more people are effected by the emanations from minerals operations, but the change may produce little additional restriction on the operations of existing firms, and, to the extent that governmental units in the changing areas have only a weak power to regulate, there may be an additional restriction even on new operations.

Since the greater powers for regulating adverse effects on other economic units are usually associated with urban forms of government or their close counterparts, an indication of the geographical spread of their regulatory power is provided directly by data on land area under their jurisdiction. Land area of identical cities over 25,000 in both the 1940 and 1950 Censuses increased by 12 pct for the country as a whole. In descending order, the percentage increases for separate regions were as follows:

West South Central	58	New England	2
East South Central	38	West North Central	7
Mountain	31	East North Central	5
South Atlantic	17	Pacific Coast	4
Middle	Atlan	tic 3	

If linear dimensions had increased uniformly, an areal increase of 50 pct would correspond to a linear increase of 22 pct in ten years. An areal increase of 12 pct would correspond to a linear increase of only 6 pct. Linear dimensions of urban areas do not increase uniformly, of course, but it is fairly clear that for the northern parts of the country and the Pacific Coast, the heightened possibility of conflicts for nearby oil drilling operation is coming from the decreasingly rural character of fringe areas rather than extension of urban boundaries. The extension of boundaries in several instances is lagging behind change in the character of the fringe areas.

# PLAYGROUNDS USURPING POTENTIAL MINES

Next consider the growth in demand for outdoor recreation. This is a factor that will especially effect conflicts involving those types of mineral activities found in few, scattered, and often scenic areas of the nation. Demand for extensive types of outdoor recreation is no doubt growing faster than population. (By extensive recreation activity it is meant those types of activity which involve a high ratio of land-to-people). Certain types of hunting and fishing qualify, as do some types of hiking and boating. Any activity involving a desire for a wilderness-like terrain or a desire for solitude probably belongs in this category. The pressure behind the attempts to keep certain areas in a more or less wild state with no forestry, mining, or other commercial activity is going to increase.

Mining may not exhibit so great a degree of incompatibility with these demands as does forestry or most types of commercial development, but there are many who believe that a wilderness-like area will become something quite different if mining is present. An excellent illustration is provided by the Porcupine Mountains case of a few years ago, where this point of view was maintained so forcefully that it was decided not to open the area to mining activity.

It should be noted that conflict between extensive recreation and mineral operations is likely to involve government land in the main, if not exclusively. While external effects of mining activities on extensive and other types of outdoor recreation are present even where land is privately owned, these effects do not seem to be of practical legal consequence so far as decision on land use is concerned. Private owners will continue to base their decisions on revenue and cost prospects.

# POPULATION AND POLLUTION—PROBLEMS OF WATER SUPPLY

Many of the conflicts that concern mineral producers involve water. These will become more pressing as time goes on. First, the demand for water is increasing as population and real income rise. Second, the demands for the services of water have a quality dimension. It is no doubt the case that some of the increasing demands for services of water are demands for water of high quality. Third, the very same factors that lead to larger demands for water-rising population and a higher volume of economic activity-also increase the supply of pollutants. Thus, pressure on available flows of water may arise from either or both of two sources: first, the sheer size of demands, especially if these are dissipative; and second, the need for larger stream flows to dilute pollutants. Water can be and is re-used, of course, but as withdrawals along a stream increase there is less time for natural regenerative processes to operate before the next withdrawal and its accompanying addition to pollution takes place. Hence there is a point at which increased demand for water-even if the uses are not dissipative—can be met only at increased cost, either in treatment of pollutants or by purification, increased storage to raise seasonally low flows, or in other costs which are associated with pollution.

A recent study directed by Nathaniel Wollman under the auspices of Resources for the Future suggests that the severity of these problems will increase. After extrapolating the quantity of water that would be used, it was found that twenty years from now the minimum flow of water "required" to meet losses of water to the atmosphere from these uses would be in excess of the maximum level flow that could be developed in several regions of the country-the Upper Missouri, the Rio Grande, Colorado, Great Basin, and South Pacific regions. Note that maximum storage could not, according to these estimates, provide a flow equal to losses of water from the projected demands, let alone provide a flow adequate to dilute the treated wastes arising from these uses.

Obviously the demands for water in these areas are going to be brought into line with available flows in some way. The rate of growth of some kinds of economic activity in these regions will have to slow down or even reverse itself. If demands are reduced by putting an adequate price on water, including penalties for dissipative and polluting uses, the rival demands will quickly sort themselves out. If this is not done by pricing, the

available flows will be rationed in some other manner, probably involving the political process in an important way. Since in some local areas minerals operations are important users of water, they can expect to be directly involved in these problems.

# WHAT DOES THE FUTURE HOLD?

Looking back over those few prospective changes that seem to have some part in determining the severity of the conflict problem for minerals, there is little that is encouraging. Increasing population and real incomes result in the growth of rival demands for the use of certain government lands. Perhaps even more important, they insure that more people and firms will experience those undesirable effects that are a concomitant of various mineral operations. Because of this, and also because of the ever-growing water pollution problem in a wider sense, mineral operations as well as other businesses will experience increasing pressure to reduce effects of their operations on others.

What does it all add up to in terms of cost? There is no basis at present for a general answer to this question. In the case of those mineral extraction operations near towns or cities there is a possibility of substantial effect, but much depends on the locations of their markets as urban areas develop. For other mineral products, effects on cost and price seem likely to be minor.

But particular mineral enterprises do not operate in a generalized fashion. They operate in specific locations, with a definite bundle of property rights, and with personnel that have a particular group of skills—skills that in some cases are specialized to certain areas. This means that a firm can easily get caught in a set of circumstances involving conflict which may be costly. While much can be done to avoid or adapt operations to an anticipated conflict, there is little prospect that the general problem of conflicts will diminish, for they will continue to arise as the inevitable consequence of continued growth of population and real output.

# PUBLIC LAND WITHDRAWALS THREATEN MINERAL INDUSTRY

by HOLLIS M. DOLE

Let it first be stated that mining is not against withdrawals. It recognizes and accepts the fact that land withdrawals are necessary for national defense, communication networks, protection of unusual and scenic sites and recreation areas, as well as for other purposes. What mining is really against is the indiscriminate withdrawal of public land for limited purposes without recognizing the possibility that multiple use of the land could be had.

The term multiple use must be defined for, unfortunately, the phrase is fast losing any worthwhile meaning. According to some proponents of withdrawals, if land can be restricted to two or more uses the land has "multiple use", regardless of how many other additional uses there are to which it could be put. It is this author's contention that multiple use must mean any use of the land as long as it can be made compatible with the other uses. For anything less than this, the term limited use should be applied. Conflicts arising from withdrawal of lands could be reduced if multiple use were recognized as including any use of the land as long as it is in accord with other uses.

# THE STRUGGLE FOR MULTIPLE USE

As the pioneers moved west following our war for independence, land, like buffalo, was considered unlimited. In the beginning, it was federal policy to hold title to public land as the trustee for the people of the new states and that these lands should be placed on the tax rolls as soon as possible after the states were admitted to the Union. When

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The Black Hills-a symbol of parks and mines.

settlers were reaching the Rocky Mountains in large numbers, a policy of joint State-Federal ownership of land within a state was established by Congress. Today most governors in the far West find the Federal Government governs about the same amount of land in their states as they themselves do.

After the policy of State-Federal ownership of land was established, there followed a period when

Congress freely passed legislation that would allow land to be acquired or designated for special purposes. Conflicts in land use were inevitable, of course, and a breakdown of special-interest use began in 1920 with an exception to the Mining Act. This law prevented claiming and possible patenting of Federal land containing certain minerals such as coal, phosphate, oil and gas, and oil shale and made them subject to leasing; actual ownership of the land was retained by the Government. Sometime later another special use was curtailed when the Taylor Grazing Act became law and, to all intents and purposes, suspended private acquisition of land through homesteading. Since that time more mineral lands have been taken from the "locatable" category and placed in the "leasing" list.

From 1953 to 1955, three important changes were made in the mining laws and one in the power-site withdrawal laws. These changes allowed for duplicate use of the same piece of land for "locatable" minerals and "lease" minerals; provided for use of the surface of mining claims for timber harvesting by the Government; granted access for roads, hunting, fishing, and virtually everything else so long as it did not materially affect mining operations; restricted still further the minerals that could be located; provided for surface management by the Government of claims located prior to passage of the law; and allowed staking of claims with controlled mining on power-site land withdrawals.

# THE HEADLONG PLUNGE TOWARD LIMITED USAGE

Even though modifications were made in some of the public land laws to allow for wider use, the laws under which withdrawals were made for parks, game refuges, wilderness areas and similar purposes remained unchanged. In fact, activity in this type of withdrawal increased, and new legislation has been proposed that would subtract even more areas of public land from multiple use and further restrict the use of land in those existing areas of limited withdrawals.

To date, the Federal Government owns approximately 48 pct of the land in the 11 western states (excluding Alaska), a total of 362.5 million acres. Of this amount, 35 million acres have been withdrawn for the "recreation-type" uses noted above. Of equal interest, the Federal land (excluding Indian lands) in the five states of Mont., Idaho, Ore., Wash., and Alaska totals 368 million acres, 65 million acres (or 17.5 pct) of which have been set aside for special purposes (power sites, military installations, etc.), parks, or otherwise closed completely or partially to the mineral industry. In Alaska alone, more than 51 million acres have been withdrawn or proposed for such withdrawals.

In addition to these lands, large withdrawals for wilderness, scenic, and recreational purposes are being considered in every one of the public land states. When totalled, they represent another 50 to 60 million acres. These proposals would set up, among other things, wilderness areas where not even tourism in its modern sense could take place. They would establish sand dune or seashore national parks, withdraw strips parallel to long stretches of highways, and give animals and their hunters exclusive use of the land.

Of all these proposals, Senate Bill No. 174, labelled "A National Wilderness Preservation System" but more commonly known as the "Wilderness Bill", would have the most damaging effect on the principle of multiple use, as it limits use strictly to the hiker and includes large areas in every western state (a total of approximately 50 million acres). This bill would also take some historic rights over land from the legislative branch of government and place them in the executive branch.

# THE NEED FOR A REASONABLE WITHDRAWAL POLICY

The present-day effect of withdrawals is obvious to mineral exploration men. Searching for deposits of value is more than simply going over mineralized areas. The geology of the region must be determined, and this is done only after on-the-ground study of large areas, many of them extending far beyond that of the zone of mineralization. Areas encompassed by the Wilderness Bill preclude geologic examinations as well as mining.

It is also known that areas which in the past were not attractive to exploration and mining are now being examined and in many cases producing ore. This is the result of one thing: change—change in techniques of exploration, change in mineral commodity usage, change in transportation patterns and availability of raw materials for processing, and change in population and manufacturing centers. This is true for the whole mineral field, but especially so for the industrial minerals.

The future effect which limited-use withdrawals will have on mining is probably of greater concern to the mining industry than the present-day effect. As each ton of ore is mined today, more than a ton of ore must be developed for use tomorrow, for there will be more people on the earth tomorrow and the per capita consumption of minerals will be greater. Since the easily discovered mineral deposits in this nation have been found, the finding of replacements will depend entirely on the amount of ground open to search. The salvation of our future mineral needs is going to rest largely in those vast areas that, to the present, have received little or no exploration.

# SUMMARY

The case for the need of exploration and mining can be simply stated: per capita consumption of minerals is increasing annually; the world population is constantly increasing; ergo, a greater quantity of minerals will be required each year.

The case for the need of withdrawals can also be simply stated: as living becomes more complex, there is a greater need for more precise communication networks, more complicated defense installations, and more research facilities isolated from population centers. Population expansion makes it imperative that sites having unusual natural beauty or unique recreation and scenic values be set aside for public enjoyment. This adds up to a definite need for more withdrawals of land.

Granting the validity of each case and the need to lessen the inherent conflict between the two, the mineral industry must be constantly alert to insure that only essential withdrawals are made. Withdrawals for special-purpose use must be kept to a minimum size, and multiple use in its broadest sense must be practiced whenever possible. Better public relations and recognition by the mining industry of its community responsibilities toward use and treatment of land are also required. By such a manner, this conflict of interests can be greatly reduced.

## **RESERVOIRS OR MINES:**

## **CAN THEIR VALUE BE EQUATED?**

by THOMAS MADDOCK, JR.

Developing water resources to meet the essential needs of our growing population may be expected to be of increasing importance to our Nation. Water is unique, however, in that it is the only resource whose need for development is understood by nearly everybody. Consequently, the problems and conflicts inherent in water-resource development may not be fully appraised in a rush to provide for the requirements of some particular group of people or section of the country.

Mining engineers concerned with the development of another group of resources, find that approval or disapproval of a particular water project depends on the local interest. While water may be a nuisance in most mines, it is usually essential to many of the processes connected with mining. Furthermore, the development of our mineral resources is associated with transportation; hence, the improvement of waterways is of importance to the mineral industry.

All of this means that the mining engineer, like everyone else, has a large stake in water-resources development. He hopes that water development will take place in a logical, prudent manner, and, like everyone else, hopes it will be done in such a way that he will gain and not be hurt, either directly or indirectly. He, like most other people, gages water-resource development on how it affects him or his community.

The resources of our stream systems differ from all others in their degree of variability. Ground water, which cannot be wholly separated from surface water, is somewhat different; in some places ground water is mined like a mineral. But the withdrawal of water from a stream—or from an underground source, for that matter—presents no problem. The greatest concern is ridding ourselves of the variability. We have too much water during floods, too little water during a drought, or the discharge of a stream system may not conform to the demands which may be made upon it.

The universal manner used to reduce the variability of flow in our stream systems and to make the flow conform to demand is to construct dams and reservoirs. Reservoirs, therefore, are an integral and essential part of any major scheme for water-resource development. Nevertheless, more of the conflicts of water-resource development have centered around the construction of reservoirs than around any other phase.

The use of land in reservoirs for other than flooding is greatly restricted if not wholly prohibited. Only if reservoir land is infrequently flooded can



Dams and reservoirs—factors in flooding mineral lands.

any other use of the land be expected, and even then there are severe restrictions on the construction of permanent improvements.

This situation affects lands which may be developed for mining or quarrying. Underground workings are affected by seepage from the reservoir, and mining may face insuperable obstacles in an attempt to handle the large quantities of water. Quarrying or open pit mining, of course, is impossible if the workings are flooded. By using dredges, sand and gravel operations can continue if the water is not too deep; but this often becomes a complex problem.

There are also indirect conflicts with reservoir development. A road or railroad may have to be relocated, adding to the cost of operation. A town needed to provide services for the mining operation may have to be moved. The shifting water level in a reservoir may increase the cost of water works to supply the mine and its facilities or the community which is associated with the mine.

Since the potentialities for conflict between reservoir construction and mineral exploitation seem to be relatively great, the question arises as to what our actual experience has been. While areas of mutual interference between the operation of mines and reservoirs have been numerous, the number of unsolvable cases has been small. Nevertheless, there are serious conflicts such as the Boundary Dam on

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the Pend Oreille River in Washington, the Oologah Dam on the Verdigris River in Oklahoma, the Keystone Dam on the Arkansas River in Oklahoma, and the Trinidad Dam in Colorado. In most instances the mineral industry lost the battle. Oddly enough the existence of a great number of abandoned coal mines has precluded the use of potential reservoir sites on some of our eastern stream systems.

In many instances means have been found to adjust damsites or to modify operation procedure to permit joint operation of the reservoir and development of mineral deposits. The manner in which the Tennessee Valley Authority was able to build its reservoirs in areas of mining activity is well known. Not so well known, perhaps, is the care taken by the Bureau of Reclamation to mesh reservoir operation and oil development in the Sanford Reservoir in the Canadian River in Texas and the Norman Reservoir in Oklahoma. Means of operation were arranged with the assistance of USBM petroleum engineers.

#### CAN WE HAVE A MINE AND A RESERVOIR?

Reservoirs are usually in river bottoms. If a river and its floods have been no impediment to mining development, it is argued that a reservoir would not either. However, strange things have happened in limestone terrains when they have been covered with water. Sinkholes have developed where none were expected and at times water losses have been so high as to make the reservoir unusable. Thus, the fact that a river may flow through a reservoir site is not a clear indication that no problems would develop after the reservoir was filled with water.

If compromises are to be effected, the geology of the reservoir area must be fully understood. Without thorough knowledge, little confidence can be placed in any plan that attempts to limit the movement of water underground or to control it once it has done so. It is much easier to solve problems and consider geology in the early planning stage than after "a report" is an accomplished fact. Opportunity should always be provided, and the mining industry should see that it is.

If specific areas where water can be expected to move underground in large quantities can be located, they may be blanketed with impervious material or if the height of water above them is small, they may be leveed or walled off. Both of these procedures have been considered in existing reservoirs when excessive seepage losses have been encountered. In addition, pumps placed at critical locations may act as a curtain to prevent the movement of water to unwanted locations. This has been done on a large scale to hold ground water accumulation to acceptable levels.

In addition, if danger to subsurface workings exists, then the reservoir elevation may be regulated so as to cover areas of high water intake for only limited periods of time. Many times, and this is particularly true of a system of reservoirs, there may be a considerable leeway in how reservoirs are managed. It is frequently possible to utilize the capacity of the higher elevations for flood control or for seasonal water supply so that they are rapidly emptied. Thus the movement of water underground may be limited through a lack of opportunity for it to do so.

How are these adjustments brought about? They result from a realization that the wisest course is that of developing all of our natural resources. In the

past and often now, the initial reaction was an indifference on the part of participants toward the national significance of the other's operations. Why is this so?

First and foremost is the lack of a community of interests between the group which wants the reservoir built and those who wish to develop the resources of the reservoir area. In the state of Washington the operators of a mine in the eastern part of the State have little in common with those who propose a power supply for a city on the West Coast. The same may be said of a farming community in mid-Kansas and advocates for flood protection in Missouri. This list could be continued, but each example would consist of at least two communities or groups neither of which had the slightest interest in the aspirations of the other.

Where there is no sharing of the damages as well as the benefits of any reservoir within a single community, the inevitable result is the development and alignment of contending pressure groups. Where State lines intervene between the contending parties, conflicts become recognized at the national level. Subsequent to the first stage of adjustment the values of the different types of resource development are assessed and presented, and an attempt is made to compare their relative values.

The benefits to be derived from reservoir construction are usually well understood. Nearly always they are related to a community or, if a large project is under consideration, to groups of communities. The benefits are usually specific in character. Water supply, power, and flood control are definite and well understood. Recreation is not in this category so far as dollar values are concerned, but it musters impressive pressure groups, with a great degree of emotional appeal.

Benefits from mining or quarrying operations are equally specific. Usually, however, these operations are sponsored by individuals or corporations rather than communities. Hence, the public is not fully conscious of the need to consider mineral resource values.

It is when we try to weigh the relative value of a reservoir as compared with another resource development that trouble occurs. How can the value of a reservoir be compared with the value of a mine, for example? The benefits flow in different channels and thus they reach entirely different groups within our society. A public water supply benefits a concentrated, discernible group; hence a reservoir which is part of a water supply does the same thing. But the benefits of a mine are spread throughout a much broader portion of the economy and, being diffused, are much harder to evaluate.

Too often the small community benefiting from a resource is compared only in size with a larger one benefiting from a reservoir. How do we evaluate a resource development which may be the only stable source of income which supplies services, public or otherwise, for a large area of low population or wealth? These are intangibles which can be recognized only by the heat of the conflicts they engender. Nevertheless, with adequate advance planning and thorough consideration of all resources in a project area, multiple use and adequate conservation of the resources can usually be achieved. The cost, with such careful planning, is usually far less than that attained with long, expensive court proceedings.

Still more difficult is the evaluation of a potential resource development in a reservoir area. At times the presence of valuable mineral deposits or of potential oil fields within reservoir areas is known or recognized. Under present demands exploitation may not be feasible. Yet such deposits are a portion of the country's reserve and as such, must be considered in any forward-looking policy.

We have no means at the present time of making a rational decision about the comparative value of a reservoir and some other type of resource development. Established "cost-benefit" procedures are inadequate. Decisions need be made on a regional or

national level.

In the final analysis it is the Congress that makes the decision as to how the country will develop its resources and decides on the relative merits of conflicting interests. Since the Congress must pass on every report proposing a Federal dam, the conflicting parties must present their case before it.

The conclusion is clear. If the mining industry wants a critical evaluation of all types of resource development, then it must be able to assess the value of mine development to the local community and to the Nation. Further, it must present its case forcefully. Thus, if the mining engineer is to win a share of those conflicts with others pressing for reservoir construction, he must first understand and be able to state clearly the local, regional, and national values which his particular type of resource development will produce. Second, he should enlist the active support of those who will benefit from his development at the local, regional, and national levels. Finally, he should thoroughly understand the need for a reservoir together with possible substitutions in location, or changes in plan that would make a specific adverse site unnecessary.

No general comment can be made on the degree to which compromises can be reached on measures which would permit joint operation of a reservoir and a mine. Too much depends upon the willingness of the parties involved to compromise. If there is a real willingness to take care of the burdens that compromise may require, then, as in the past, much success may be expected. If adequate planning is provided, usually we can have the water development and still provide for mineral production. Both the mining industry and the water-development planners should work to that end.

## **URBANIZATION — IMPETUS AND DETRIMENT** TO THE MINERAL INDUSTRY

by HAROLD B. GOLDMAN

This nation's explosive population growth rate of 21/2 million persons annually will make increasing demands for new roads, homes, stores, churches, theaters, hospitals, and industrial and municipal facilities. These requirements have given an impetus to the production of construction raw materials, and today, tremendous tonnages of sand, gravel, crushed stone, limestone, cement, and gypsum are being consumed each year.

Despite the dependency of metropolitan growth on these raw materials, urban expansion often works to the detriment of the production of the basic minerals. As a community expands, raw materials such as clay for brick, crushed rock for roads, and sand and gravel for concrete are needed, and the industries that produce such products are encouraged. Since these are low cost commodities, the mining operations use suitable deposits as close as possible to the consuming areas, that is, the population centers. However, once the community is established and begins to grow, it gradually encroaches upon these previously established operations and the mining operator suddenly finds himself inside the city limits and subject to city ordinances. The new residents in the immediate vicinity of the pit or quarry consider it a nuisance and resent the hazard of trucks, the noise and dust, and the unsightly excavation. Pressure is brought to bear on the civic leaders to restrict the operation

San Francisco-a case in point.

through various ordinances such as load and speed limits on trucks, restricted hauling routes, limited hours of operation, and dust control. Blasting becomes more and more restrictive and ultimately,

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the only alternative to the operator is to shut down his operation and move to a deposit farther away and outside the city limits.

In former years, it was possible to find other sources of clay, rock, sand and gravel still within easy and economical hauling distances so that the only inconvenience and expense incurred by the operator was in moving. This is not the case today. The easily accessible deposits in most instances have been depleted or zoned out of existence and submerged by urban expansion. The old idea that stone, sand and gravel can be found anywhere is false. Raw materials are now imported from deposits situated as much as 50 miles away from the larger metropolitan consuming areas. The added transportation cost must be passed on to the consumer and for large scale municipal projects requiring great tonnages of construction raw materials, this cost becomes very significant to the

Absorbing transportation costs is not the only way in which urban citizens lose. Often the new deposits being worked at a great distance from the consuming center are of inferior quality when compared to the original source, yet they must be utilized because the expense of importing higher quality material from a more distant source would be prohibitive. Thus the quality of construction

suffers and maintenance costs rise.

Each decade urban settlement extends over an additional 15,000 sq miles in and around our metropolitan complexes. The President's Materials Policy Commission estimated in 1952 that 15 million acres of farm land would be taken by the growth of cities, roads, and airports from 1950 to 1975. It seems probable that the urbanized areas will increase from the 161/2 million acres in 1950 to between 30 and 40 million acres in 1980.

Already many valuable mineral deposits have been submerged in the wake of urban expansion. For example, in San Diego County, an excellent molding sand used in aluminum and brass casting came from a pit which had to be abandoned several years ago because of an encroaching housing development. This same type of sand underlies a large part of the City of San Diego, and although it is an excellent material for making castings, it is not likely that further deposits will be opened up

within the city limits.

Similarly, other significant examples were the closing of a diatomite quarry, cessation of a salt works, closing of brick plants, abandonment of rock quarries that were active for 20-30 years, shut-down of a cement plant, and the closing of a pyrite mine. Besides these deposits which are now engulfed, other deposits located at a distance from a city but ringed by smaller population centers cannot be exploited because of the difficulty of haulage through these communities. This situation is best exemplified in the Peninsula area of Northern California where high quality rock occurs in the hills bordering San Francisco Bay. Quarries cannot be opened as the only access roads down from the hills go through the numerous small cities which have built up on the flanks of the hills.

#### HOW PLANNING CAN HELP

There is little reason not to believe that judicious planning can result in wise land use and conservation of our mineral resources. The diverse uses of land for agriculture, recreation, residential and industrial urban development, and mining can be integrated with enough foresight and determination to serve everyone's purposes. For example, a rich deposit of mercury ore which had been known to exist but never fully exploited was uncovered during the grading for a housing development in Redwood City, Calif. Permission was granted by the city to mine the ore and a substantial quantity of mercury was ultimately recovered. When the mining operation was terminated, the land was filled in, regraded and the homes built.

Integration of purposes and planned conservation during mining operations can also be made to pay off both financially and in good will. An extensive quarry operation that provided about 5 million cu yd of fill for the San Francisco airport is now the site of hundreds of homes. In Los Angeles, the Great Lakes Carbon Corp. is integrating a dimension stone operation with a real estate development. As the stone is removed, the land will be leveled for choice home sites. In the Midwest, a progressive crushed stone company demonstrated that quarrying can be turned to the community's advantage by flooding the pit to form a lake and then surrounding it by trees and shrubs.

#### SUMMARY

Long range planning can help conserve our mineral deposits for future exploitation, but the cooperation of planning bodies, civic officials, and mineral producers is essential for a properly integrated program.

City planning bodies must be acquainted with the idea of reserving mineral lands. While the need for preserving other natural resources is recognized by progressive planners, the idea of preserving mineral lands is new. Land can be maintained as recreation or wildlife preserves, or used for such activities as farming, lumbering or grazing until the need for the underlying mineral be-

comes more pressing.

Civic officials must give consideration to the needs of the community for raw materials and to the redevelopment of the land after the deposit is mined out. By setting aside future reserves, the community can be assured of a supply of local raw materials at low cost. It is the obligation of the civic leaders to apprise themselves of the mineral wealth within their jurisdiction and carefully consider the additional cost to the community that would result by permitting their local sources of raw materials to be submerged by expansion of the city.

Perhaps a concluding example can best summarize what local government can do to handle the needs of a rapidly growing area. The City of Los Angeles recognized the problem of losing mineral lands to urbanization and has attempted to integrate some of its mineral deposits with the overall expansion program before these deposits are overrun by homes. Consulting engineers, employed to study the sand and gravel resources in the San Fernando Valley, outlined usable deposits which were subsequently set aside and zoned for mining. Designation of these sites has forestalled urban encroachment until the deposits are depleted. When this time comes, the pits will become refuse disposal areas, then filled in again and restored for

MINING ENGINEERING presents the annual membership report of the Society of Mining Engineers; see page 721.

# 1961 Membership Directory

society of mining engineers of aime



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Formerly Research Dev. Engineer and Metallurgist for Dorr-Oliver, Metallurgist, Miami, Copper, Miami, Ariz., Met. E., Univ. of Ariz. College of Mines, 1945.



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# **SME Membership Directory**

Listings and addresses are correct as of Apr. 15, 1961

Officers Directory begins on page 722

### **EXPLANATION OF CODING**

#### Alphabetic Section (Page 729):

The letter following the member's name indicates grade: M-Member, A-Associate, J-Junior.

The numerals following member's grade indicate year of election.

The letter following year of election indicates primary Divisional affiliation:

A—Mining & Exploration F—Coal
B—Minerals Beneficiation G—Petroleum
C—Iron and Steel H—Industrial Minerals
D—Extractive Metallurgy J—Council of Education

E—Institute of Metals K—Council of Economics

#### Geographic Section (Page 837):

The asterisk (\*) preceding the member's name indicates availability for consulting work.

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Established as a Society February 25, 1957

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#### ROBERT PEELE MEMORIAL AWARD

1961\_None

#### PERCY W. NICHOLLS AWARD

(Joint Award with ASME) 1960—CARL EUGENE LESHER

#### HAL WILLIAMS HARDINGE AWARD

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#### OTHER AIME AWARDS OF INTEREST TO SME

#### MINERAL INDUSTRY EDUCATION AWARD

1961-Nene

#### ROSSITER W. RAYMOND MEMORIAL AWARD

1961-DOUGLAS W. FUERSTENAU

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Graduate Mines)

Mines)
Undergraduate Division-William G. Pariseau (North Pacific Section, University of Washington)

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United States Steel Corporation
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Pittsburgh 30, Pennsylvania

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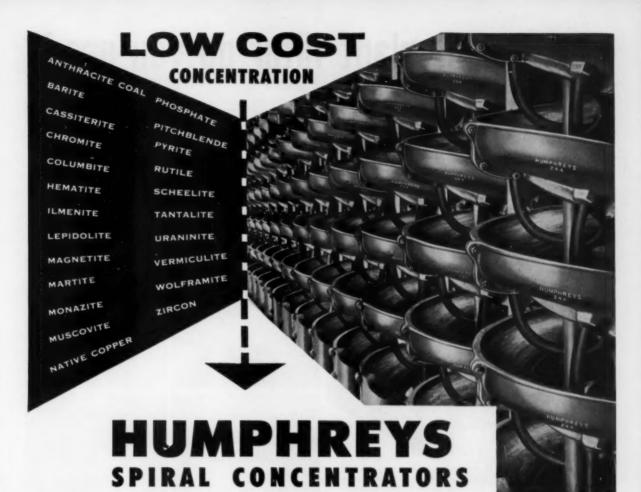
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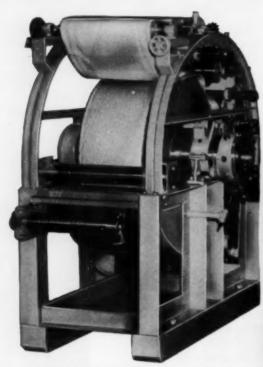
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Zahary, George, J54 A
Ming Engr, Steep Rock Iron Mines, Ltd.,
Steep Rock Lake, Ont., Canada
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Minak, Rue Vaziri, Teheran, Iran
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Gen Mgr, Southwest Potash Corp., P. O.
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Pres & Gen Mgr, U. S. Tungsten Corp.,
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Zeckhausen, P. W., A53
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Zegeer, David A., M55 F

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Div Supt, Bethlehem Mines Corp., Jenkins,
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Old Nati. Bk. Bldg., Spokane, Wash.
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Res Geol, Anaconda Co., 526 Hennessy
Bldg., Butte, Mont.
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Dist Dir, Pub Rel, U. S. Steel Corp., 710
Wolvin Bldg., Duluth, Minn.
Zentner, Lewis S., M53 A
Valuation Engr Ming, U. S. Bur. of Land
Mgmt., Calif.
Pruit Bldg., Sacramento,
Calif.
Zerbe, T. W., M44

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Mgr, Northwest Magnesite Co., Chewelah,
Wash.

Wash.
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Riverton, Neb.

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Mineral Eng. Eagle Picher, Galena, Iil.
Zievers, James F., A59 B
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Cicero, Ill.
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Geol, Olin Mathieson Chem. Corp., 460
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R.R. Box 456, Ringwood, N. J.
Ziminsky, George L., J53 A
Purchasing Agent, Atlas Powder Co.,
Wilmington 99, Del.
Ziminsky, Richard W., J54 A
Mine Engr., Standard Lime & Cement Co.,
Martinsburg, W. Va.
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Sr Geol, M. A. Hanna, Iron River, Mich.
Zimmer, Peter F., J58
241 S. 1200 E., Salt Lake City 2, Utah

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Ch Explor Sect, U. S. Army Engr. Dist.
Ort.
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Platteville, Wis.
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P. O. Box 664, Scoctro, N. M.
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Zyderveld, Pieter H., M28 B

Grad Stud, 24 Crane St., Amsterdam, N. Y. Zyderveld, Pieter H., M26 B Ambassader, Netherlands, Embajada de Holanda, Apartado 4100, San Jose, Costa Rica

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Burke, Boles, Jr.
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George, Paul E.
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Moore, Melvin C.
Moore, Melvin C.
Myers, Donald L.
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Reed, Eugene P.
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Salter, Marvin L.
Schlick, J. R.
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Scott, J. R.
Scott, J. R.
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Thomas, Ester L., Jr.
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Brown, James A.
Brown, James A.

Brown, James A. Herren, Elijah O. Roberts, S. Jay Towers, Ralph White, Richard S.

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UNIVERSITY

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\*Andersen, Burton L.
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Horton, Alan G.
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Collier, Clark L.
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Farent, Amand
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Reeve, Robert C.
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Suntrama Mining Co., Inc.
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Superior Oil Co.
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Johnson, Kenneth A.
Van Natter, P. C.

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U. S. Geologica.
Div. Saarela, Leo H.
Western Drilling & Equip.
"Gunnarson, LeRoy
Yukon Equipment Inc.
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Richards, Roscoe S.
"Waterfield, Henry W.
"Zaegel, William G.
Other.
William F.

\*Zaegel, Whisiam F.
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Cinkovich, Thomas L.
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Saunders, Robert H.
Univ. of Alaska
"Beistline, Earl H.
"Cook, Donald J.
"Renshaw, Anson L., Jr.
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Waugaman, Wm. I.
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Lomen, Alfred J.
Other

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Other
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Thorne, Robert L.
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U. S. Forest Service
Banta, Howard E.
Other Oth Herdlick, Jared A. Pekovich, W. S. Susie, H. F.

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Edgecumbe Exploration Co. Morgan, Glenn H.

# SKAGWAY

Other Tunley, A. T.

# SOLDATNA

Other Corr, Tommy

# SPENARD

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# SUTTON

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# TALKETTNA

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# WISEMAN

Other Leonard, Harry B.

# WASILLA

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Crawford, Douglas J.
Denny, Frank W.
Fensi, Orazio F.
Gensman, Owen A.
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Wyatt, John H.
Yentzer, Winfield C.
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Bagdad Copper Corp.
Bogart, Robert C.
Jones, Edward L.
Cyprus Mines
Friedman, A. A.
Hunt, Alan W.
Sierakoski, Joe O.
Sundeen, C. R.
Yundt, L. D.

# Other Guest, Gaylen W.

# BENSON

Apache Powder Co. Crawford, Howard D. Towle, Louis W.

Phelps Dodge Corp.
Allen, Phil F.
Chandler, Dwight L.
Coggin, G. W.
Dahlke, Gustav A.
Durrenberger, Joseph W.
Gedge, George
Himebaugh, Arthur E.
Hogue, William G.
Holmes, Stanley C.
Ladd, John H.
Little, William W.
Metz, Harry E.
Follman, William F.
Travis, George E.
Troutman, Charles V.
Van Etten, George A.
Other
Goar, William

Other Goar, William Pincock, W. K. Riddell, Richard D.

# BILLHEAD CITY

Other Scott, Carroll T.

# CASA GRANDE

Transarizona Resources, Inc. Freeman, G. A. Other Tucker, Thomas L.

# CHANDLER

Self Employed \*Hawn, George

# CHRISTMAS

Insp. Consol. Copper Co. Mitchell, Ronald J.

# CLAYPOOL

Harold D. Maryott & Co. Maryott, Harold D.

# CLIFTON

Other
Berry, Tom W.
Bonnie, Norman C.
Tea, Joseph H.
Willis, O. B.

# CONGRESS

U. S. Tungsten Corp.
\*Zannaras, John Philip

# COOLIDGE

Self Employed \*Pyrah, D. A.

# DOUGLAS

Phelps Dodge Corp.
Allan, James W.
\*Conder, L. Stevens
Davis, John H., Jr.
Geshell, Peter S.
Lanigan, Joseph
Lawson, Walter C.
Ludden, Raymond W., Jr.
Ludden, Robert B.,
Maillot, Elmer E.
McGuire, Cecil E.
Miller, Charles P.
Pullen, Jack Boon
Smith, Arthur R.
Sumner, John S.
\*Torgersen, Edward H.
Other

ner Davis, Leverett Uren, William J. Turney, P. M.

# FLAGSTAFF

Ariz. State College Alenius, E. M. J.

# GLENDALE

Self Employed \*Deci, David A.

A. S. McClintock Company Weaver, M. B. Metate Asbestos Corp. \*Neal, Jack L. Mine Supply & Hdwe. Co. Sullivan, William A. Self Employed Botsford, C. A. \*Peterson, Nels P. Other Other Williams, E. G.

# GRAND CANYON

Western Gold & Uran. Inc. Kofford, Max E. \*Winterhalder, Edwin C.

## GREER

Other Dentzer, Edward G.

# HAYDEN

Amer. Smelt. & Ref. Co. Groff, E. E.
Kennecott Copper Corp.
Allen, George J.

\*Conwell, Cleland N.
Cox. Howard Duane
Hood, John M.
Johnson, Raymond C.
Morris, Abe P.
Patton, John F.
Sewell, George P.
Sparks, Earl H.

\*Stocker, James E.
Willoughby, Robert A.
Winn, W. Howard
Woodruff, Frank G.

ier Mulholland, L. E. Vlasak, William M Woods, Robert G.

# HEREFORD

Other Wilcox, Joseph A.

# HUMBOLDT

Shattuck Denn Mining Corp.

\*Jones, Charles A.

\*Waples, Bee R., Jr. Other Apperson, Claude H.

# INSPIRATION

INSPIRATION
Inspiration Cons. Copper Co.
Anderson, Thomas M.
Bamerio, Ralph V.
Bilson, Thomas E.
Carne, James L.
Hawes, William E.
Henderson, Thomas D., Jr.
Honeyman, Pharic D. I.
Johnson, David W.
Lundy, James H., Jr.
Mellus, Herbert H.
Moran, Lawrence K.
Neal, Abner H.
Olmstead, Hugh W.
Parker, Wesley H.
Power, Kenneth L.
Reed, E. F.
\*Rice, Fred D., Jr.
Rodolff, Dale W.

Schrader, William D. Sorstokke, Harold W. Struz, Carl G. Theller, John J. Thomson, Norman G. Turk, Albert J. Watts, James R. Weed, H. Carroll Whitney, Bruce B. her

Oth ner Cronin, John Ahearn Musgrove, Paul M., Jr.

# **JEROME**

Big Hole Mining Co. Gemmill, Mark Other Gemmill, Richard H. Reber, Louis E., Jr.

## KEARNY

Other ner Cooper, John A. Corfield, George W. Hoyt, C. Leroy Jones, Robert M. Lefler, C. Arthur

### KINGMAN

Other Charles, B. E.

## LOWELL.

Phelps Dodge Corp. Niemi, Alfred E. Other Larsen, Joseph U. Wenner, Conrad A.

Self Employed
\*McCarthy, Donald P. Other Smith, Lewis A.

# MIAMI

Copper Cities Copper Co.
Napp, Gordon E.
Miami Copper Co.
Bean, James J.
Coll, Ben R.
Fletcher, James B.
Fowells, Joseph E.
Gray, John H.
Henderson, Thomas D., Sr.
Hughes, Robert P.
Simmons, W. W.
Spencer, John J.
Stover, Maynard M.
Other

Other, Coles, Henry O. Mathewson, Donald E. Slack, William G., Jr. Sloan, William F.

# MORENCI

Phelps Dodge Corp.
Abell, Leo M.
Alexander, Albert L.
Armstrong, James L.
Baie, Richard P.
Berra, Felix G.
Broderick, Adrian J.
Conger, William C.
Cross, Richard R.
Doerges, Robert F. Conger, William C.
Cross, Richard R.
Doerges, Robert F.
Durek, Joseph J.
Ennis, Jerry R.
Enrico, Tony
Finton, M. H.
"Green, Bennett L.
Griffith, William A.
Harbison, L. E.
Haxby, Ronald L.
Jacoby, Dwight C.
Lentz, John A., Jr.
Lines, Bill F.
Link, Paul E.
McFarland, John R.
McWilliams, Thomas D.
Moolick, Richard T.
Olson, Lester D.
O'Neil, George H.
Orr, David H., Jr.
Pettibone, Michael H. O'Neil, George 1.
Orr. David H., Jr.
Pettibone, Michael H.
Riley, Chieo C.
Scheier, Aloysius M.
Scheier, Paul R.
Sorvisto, Charles A.
Stanley, Joe B.
Stock, John F.
Troxell, R. C.
Waters, Louis H.
ther

Waters,
Other
Bacon, Vance N.
Barr, Richard C.
Bishop, Andrew M.
Brooks, Wesley
Campbell, John R.

Fitzgerald, M. J. Hughes, Martin Lines, Herbert L. Richards, Wm. T. Stott, Charles E., Jr. Tysseling, J. T. Urband, H. T.

#### NACO

Compania Minera de Cananea Brown, Calvin C. Humphrey, Wm. A. Velasco, J. Ruben

# ORACLE

Other Nichols, Henry W. Zappia, Michael A.

### PARKER

Other Cornejo, Luis A.

# PATAGONIA

Lenon Engineering Office

\*Lenon, Robert
Self Employed

\*Millar, William B. Other Yanez, James A.

# PHOENIX

Arizona Highway Dept.

\*Gallaher, B. Jack

\*Scott, Lewis E.

Arizona Dept. Mineral Re-\*ScuArizona Dept.
sources
Flagg, Arthur L.
Knight, Frank P.
Lane, Travis P.
Arizona Mack Truck Sales
\*Fletcher, Frank X.
Arizona Small Mine Op
ators Assoc.
Willis, Charles F.
Arizona Wholesale Sur

Supply

Arizona Wholesaie Supply
Co.

\*Miller, Alden W.
Armco Steel Corp.
Moeller, J. Edwin
Barrett Haentjens & Co.
Dodge, Ralph O.
S. & K. Mining Co.
Kalaf, Abe M.
Kalaf, George
Clico Lab. Supply
Maryott, Michael T.
Colorado Fuel & Iron Corp.
Helms, Luther S.
Evans, Kitchel & Jenckes
\*Kitchel, Denison
General Electric Co.
Blair, Robert R.
Gladding, McBean & Co.
Swartz, Tench G.
Guynn, Twitty & Slewwright
Twitty, Howard A.
Harnischfeger Corp.
\*Taylor, John H., Jr.
Philip S. Hoyt & Son
\*Ployt, Philip S.
Hughes Tool Co.
Ruby, Robert J.
J. T. Jenkins Company
Hyde, Harold H.
Johns-Manville
Anklam, J. Richard
Sutton, K. Parker
Link Belt Co.
Bugbee, Earl H.
Magnesia & Refractories
\*Menzi, Fred W.
Marion Power Shovel Co.
Johnsen, Eugene R.
Minneapolis Honeywell
Agee, Jack C.
National Castings Co.
Thomas, John F.
National Equipment Co.
Hoag, Lesile F.
Ogson, Peloubet & Co.
\*Pogson, Percy W.
Shute & Elsing
Elsing, William T.
U. S. Government
Harmon, John P.
McCullough, Douglas L.
Morgan, Edward A.
Pardee, Jack McK.
Van Waters & Rogers, Inc.
Whittemore, Ralph C.
Warne-Sergent Engrs.
\*Ellis, Thomas J.
John Allen Ware & Assoc.
Ware, John A., Jr.
Self Employed
\*Dunning, Charles H.
\*Foster, George K.
Godfrey, Ralph G.
Ladendorff, G. Henry
Lichty, Lyall J.
\*Rice, Neil A.
\*Rodman, Earl G.

\*Strutzel, J. J., Jr.
\*Tamplin, William W.
\*Tognoni, Hale C.
\*Tucker, Lee E.

"Tucker, Lee E.
her
Beckett, P. G.
Cody, Benjamin H.
Conklin, Quentin E.
Crawford, William P.
Engelder, Oscar G.
Fagerberg, Dixon
Ferguson, John D.
Fujli, Muneo
Isbell, R. S.
Keyes, Harmon E.
Kinnon, William C.
Luke, Russell P.
Marsh, William J.
Mills, Robt. C.
Moyer, Dari A.
Nicholas, Howard B.
Roberts, J. E.
Robins, William A.
\*Ruggles, Guy H.
Tuck, Frank J.
Utermohle, G. E., Jr.
Veach, Edward A.
Webber, Benjamin N.
Whisier, Thomas C., Jr. Oth

#### PORTAL.

Self Employed \*Troller, Theodor H.

## PRESCOTT

Montans Phosphate Prod. Co.
Phillips, John S.
Shattuck-Denn
"Bombardieri, Louis F.
Still & Still Consulting
"Still, Arthur R.
"Still, Jack W.
Tarr, McComb & Ware
Commercial Co.
Ware, John Allen
U. S. Government
Alexander, Donald J.
Self Employed
"Lintz, Mark
"Zinkl, Andrew J.
Other

Other \*Gibbs, Fred Kentro, Dan M.
Tomkinson, Elmer R.
Webb, Rockwell L.
Whitehead, Gilbert

Kennecott Copper Corp.
Ballmer, Ray W.
Bishop, Harlod W.
\*Chambers, John R.
Giroux, Robert O.
\*Grigsby, Harry G.
Johnsen, S. F.
Metz, Robert A.
Miller, Leonard J.
Vance, Kenneth
Van De Water, J. C.
Other

Other
Dickerson, A. L.
Dunn, Richard L.
Garabedian, P.
Simpson, Donald L.
Taylor, Charles W.
Winkle, Robert F.

# RILLITO

Arizona Portland Cement Co. Chiaro, Dominic A Pilerce, Oliver

# SAFFORD

Kennecott Copper Corp. Cook, Annan Smyth, Sam K. \*Austin, Edward A. Foote, Kay W. Tomkinson, Joe A.

# SAHUARITA

Amer. Smelt. & Ref. Co.
Bloomfield, G. H.
Desvaux, Jack V.
Fall, Sam C.
Keevan, Michael W.
Leinis, P. A.
McClain, Charles W.
Meen, Robert B.
Sense, J. J.
Vincent, J. D.
Isbell Const. Co.
Lamb, Kenrick, L.
Shahan, James F.
Turney, Irvin & Assoc.
\*Irvin, G. W.

#### SAN MANUEL.

San Manuel Copper Corp.
Acton, Leslie C.
Ash, James L.
Buchanan, John F.
Buchella, Frank H.
Collier, William R.
Cookon, Vincent I.
Crenshaw, Ancel H.
Dopson, Gaylord W.
Dorscheid, Gerald W.
Dorscheid, Gerald W.
Enright, Maurice A.
Goodwin, James W.
Goss, John W.
Heald, David D.
Hearon, Tom E.
Jacobson, Max B.
Pelletier, John D.
\*Pillar, Charles L.
Ridinger, David C.
Simpson, John D., Jr.
Staley, E. Keith
Tiffany, James C.
Toble, Raymond L.
Other Oth

Burke, Harry K.
Cigliana, Charles F.
García, Meliton M.
Hall, Arthur B.
Matthews, Gilbert J.
Nilsen, J.
Sablich, John W.
Seany, Hendrik
Snodgrass, J. E.

#### SCOTTSDALE

Self Employed
\*Pennebaker, E. N.
\*Richards, Russell L. Other Higbie, Hamilton A. Lipphardt, Louis E.

## SELLS

Ballam, Jack C.

# SILVER BELL

American Smelt. & Ref. Co.
Anzalone, Salvatore A.
Barnes, Robert A.
Burrill, Scott L.
Cederstrom, Robert R.
Chase, Clement K.
\*Conger, Harry M.
Corson, Donald R.
Haynes, Charles W.
Jameson, D. R.
Knight, Arthur T.
Rice, Howard H.
Robinson, Ellis A.
Romney, Archie Burrell
Salter, Russell
Self Employed
\*Pilz, Conrad W.
Other

Other Green, Robert E. Reiner, Roman A

# SUPERIOR

Magma Copper Co.
Augustadt, Garvin L.
Caldwell, Edward J.
Cooksley, Martin C.
Gardner, Darrell
Goss, Wesley P.
Hammer, Donald F.
Milligan, Glenn D.
Sell, James D.
Soulé, Claude L.
Steele, Hubert J.
Thompson, D. E.
Van Voorhis, Bernard
\*Wisner, Del D.
Other

Wisher,

Bowman, Jack A.

Cafarelli, Anthony K.

Conrad, Walter E.

Crosby, Fred

Mannheimer, L. H.

Mashaw, Robert F.

Rex, Halder J.

Sherman, Fred W., Jr.

# TEMPE

Arizona State Univ. Evensen, Charles G. \*Nutt, Merle C.

# TUBA CITY

Rare Metal Corp. of Am. Gommel, Carl F.

# TUCSON

American Cyanamid Co. McAllister, J. A.

American Exploration & Min-ing Co.
Johnson, Fremont T.
American Metal Climax, Inc.
Farker, Pierce D.
American Smelt. & Ref. Co.
Courtright, Jas. H.

Courtright, Jas. H.
Hall, Arthur C.
Kinnison, John E.
Mahoney, William R.
Owsley, Frederick D.
Richard, Kenyon E.
Snedden, T. Alfred
von den Steinen, Karl A.
Warne, I. B.
Welch, Reed F.
Anaconda Co.
\*Barber, George Arthur
Keily, James L.
\*Pickard, Paul H.
Banner Mining Co.
Bowman, Allan B.
\*MacKenzie, Francis D.
Venable, Boyd W.
Bear Creek Mining Co.
Bingel, James R.
Clark, Jackson L.
Downey, Harold J.
\*Haworth, Allen H.
Michel, Fred A., Jr.
Mancuso, James D.
\*Robinson, Raymond F.
Schafer, David W.
Walker, Bryant D.
Walthier, Thos. N.
Wheeler, Eugene W.
Worthington, Joseph E.
Colorado Fuel & Iron Corp.
Klein, Eugene F.
Den Baars, Dirk
Duval Sulphur & Potash Co.
Aurand, Edwin L.
Buchella, Frank H., Jr.
Clippinger, Donn M.
Curtis, Charles H.
\*Jancic, Thomas
Lewis, Ezra H.
Livingston, R. W.
Lynch, Dean W.
Messer, Ben G.
Phillips, Ira B.
Sayers, Robert W.
Wilhelm, Bruce L.
Food Mach. & Chem. Corp.
Eastmoore, Norman E.
Heinrichs, Geoexploration Co.
\*Heinrichs, Geoexploration Co.
\*Heinrichs, Geoexploration Co.
\*Heinrichs, Walker E., Jr.
Marlatt, John W.
Reeves, George E.
Hoagland & Dodge Drilling
Co.

Marlatt, John W.
Reeves, George E.
Hogdland & Dodge Drilling
Co
Dodge, Theodore A.
\*Seel, Charles P.
Jones-Feer & Winkleman
Falmquist, John M.
Kern County Land Co.
Wallace, Wayne K.
Kerr-McGee Oil Ind., Inc.
Corn, Russell M.
Werts, Larry
Lewisohn Copper Corp.
Chilson, Richard E.
Martin & Assoc.
\*Martin & Assoc.
\*Martin, Ben H.
Metler Bros. Drilling Co.
Metler, Edward R.
Metler, Frank C.
The New Jersey Zinc Co.
Bulmer, Donald Clark
Pima Mining Co.
Bassarear, John H.
Beebower, Arthur G.
\*Hernlund, Robert W.
\*Journeay, John A.
Komadina, George A.
Martin, Michael D.
Nichoison, Marion H.
Olk, James F.
Snelton, Derek C.
Spaulding, E. D.
Southwest Ventures Inc.
Stranahan, Daniel M.
R. C. Still Co.
Luzadder, James F.
L. C. Vought Co.
\*Vought, Leland C.
Western Machinery Co.
Benedict, Louis P.
U. S. Bureau of Mines
Fillo, Paul V.
Hardwick, William R.
McKinney, William R.
McKinney, William A.
Rutledge, Gerald E.
State Dept. Mineral Resources
Johnson, Axel L.
Univ. of Arizona

State Dept. Mineral sources Johnson, Axel L. Univ. of Arizona Balla, John C. \*Bikerman, Michael Chapman, Thomas G. Cunningham, John B. Dotson, Jay C.

\*Drevdahl, Elmer R.
Forrester, James D.
\*Hewlett, Richard Floyd
\*Jinka, Jim E.
\*Krumlauf. Harry E.
\*Lacy, Willard C.
\*Leaming, George F.
\*O'Haire, Robert T.
\*Olson, Harry J.
\*Pierce, H. Wesley
\*Roseveare, George H.
\*Schottler, George R.
\*Smith, Sigmund L.
\*Titley, Spencer Rowe
Wilson, Eldred D.
elf Employed

Wilson, Eldred D.
Self Employed

\*Barton, Joseph C.

\*Bruhn, Henry H.

Chambers, Arthur E.

\*Clark, Leonard C.

\*Congdon, Stephen H.

Huckins, Daniel L. E.

\*James, Robert C.

\*Mitcham, Thomas W.

Owens, Sherwood B.

\*Phelps, Harlow D.

\*Sawyer, Thorp D.

\*Splane, John L.

\*Stephens, Frank M.

\*Stone, Edwin A.

\*Storms, W. Rex

Verity, Victor H.

Other

Storms, W. Rex
Verity, Victor H.
Other
Allen, William R., Jr.
Atwood, George E.
Barr, Aifred T.
Barrett, Bob
Bennett, Harold J.
Bentzen, Charles M.
Bienemann, W. J., Jr.
Blucher, A. G., Jr.
Brittain, Dale C.
Brough, Paris V.
Byrkit, James W.
Casiraghi, Gilbert A.
Channing, R. H.
Cloeter, John J.
Daniel, Robert B.
Dickinson, R. G.
Douglas, Lewis W.
Duff, Grover J.
Eyde, Theodore H.
Farnham, Lloyd L.
Gay, Jack E.
Harvey, Norman L., Jr.
Head, Paul A.
Hefty, H. L.
Heineman, Robert E.
Herde, Roy
Higble, John J. Harvey, Norman L., Jr.
Head, Paul A.
Hefty, H. L.
Heineman, Robert E.
Herde, Roy
Higbie, John J.
Holderness, Ed.
Howell, Fred H.
Johnson, John A.
Kumke, Chas. A.
Lansing, Bronson C.
Lewis, P. A.
Locrabbel, William H.
\*\*McCabe, George P.
McRae, Otis M.
\*\*McCabe, George P.
McRae, Otis M.
Merz, A. Russell
Morton, Erle D.
Murray, Joseph W.
Nelson, Donald J.
Newman, David F.
Norman, Rolland W.
Nye, Thomas S.
Patten, T. M.
Purdy, C. P., Jr.
Pilling, John M.
Purdy, C. P., Jr.
Richardson, Carl B.
Runyen, John B.
Russell, Jack E.
Secrist, Stanley M.
\*Suddness, Odin A.
\*Sundness, Odin A.
\*Sundness, Odin A.
\*Sundness, Odin A.
\*Tainter, S. L.
Thomas, Robert W.
Thurmond, R. E.
Waldler, W. W.
\*VARDEN!

# WARREN

Other
Clark, Henry D., Jr.
Crowley, James S.
Gilbert, A. J.
Hunt, William J.
Kolessar, Joseph Jr.
Newett, John W.
Phillipi, Fred L.
Sellers, J. K.
Shelton, Thomas L.

# WICKENBURG

Mohave Mining & Milling Co.
\*Pate, M. L. Other Lynn, H. F.

# WILLCOX

Ariz. Hwy. Dept. \*Bartlett, Sidney S.

# Arizona-Arkansas

## WINDOW ROCK

The Navajo Tribe Collins, Claro

#### WINKELMAN

Inspiration Cons. Copper Co. Brick, Carl W. Eastlick, John T. Kuhn, John G.

# ARKANSAS

# BAUXITE

Aluminum Co. of America
White, David J.
Magnet Cove Barium Co.
"Hardinge, Byron C.
"Sperberg, Richard A.
Reynolds Mining Corp.
"Honke, Martin T., Jr.
Krause, John R.
McFarlin, Jack C.
"Petrick, Alfred, Jr.
York, Roy J., Jr.

#### BENTON

Blancke, C. D., Jr. McDonald, R. T. Wagner, George M.

# BRYANT

The Milwhite Co., Inc. Hess, Albert J.

## DIERKS

U. S. Barite Co. \*Metcalf, Harry S. K.

# EUREKA SPRINGS

Allen S. Crowley Crowley, Allen S.

# FAYETTEVILLE

Univ. of Arkansas \*Konig, Ronald H.

# FORT SMITH

Evans Coal Co. McLane, Fred Quality Excelsior Coal \*Boyd, B. Degen

Silica Prod. Co., Inc. Cooke, Sam C.

# GRAND JUNCTION

Climax Molybdenum Duggan, Edwin J.

# HOT SPRINGS

Dierks Forest Inc.
\*Libbey, Donald L. Other Dierks, F. M., Jr. Laughlin, Alex Wm.

# LITTLE ROCK

Big Rock Stone & Mat. Co.
Howell, Theodore M.
Reynolds Mining Corp.
Ryan, Edwin John
Zeglin, R. H.
Ark. Geol. & Conserv. Comm.
\*Sterling, Philip J.
\*Williams, Norman F.
Self Employed
\*McElwaine, Robert B.
Other \*McKiwaine, Other Cazort, John G., Jr. Dickinson, Tyndail Fuller, Julian A. Hardy, McCombs Kidd, Benny Lundmark, R. J. Olsen, Oscar A. Stone, Charles G.

# MALVERN

National Lead Co. National Lead Co.
Benstom, Orlando J.
Castelli, August V.
Farrell, Edward C.
Goodrick, James W.
Haibert, Wm. A.
Higgins, Albert J.
Magnet Cove Barium Corp.
Travis, James J.
Self Employed
\*Pond, Walter F.

# Arkansas-California

Townley, W. E.

NORTH LITTLE BOCK

Holbrook, Drew F.

STUTTGART

Self Employed \*Kazmann, Raphael G.

# CALIFORNIA

#### ALAMEDA

Pacific Coast Engineering Co. Ramsden, C. D.

# ALHAMBRA

\*\*C. F. Braun & Co.

\*\*Dorenfeld, Morton H.
McCauley, William H.
Mineral Materials Co.
Redhead, Melvin W.
J. Moran Co.
Moran, William J.
The Natl. Filter Media Co.
\*\*Thompson, George W.
Self Employed
Baker, Thomas C.
\*\*Woodruff, Seth D.
Other

# Other Downes, F. A. ALLEGHANY

El-Dorado Plumbago Mine
\*DeGrio, Roland P.
Original Sixteen to One Mine, Bennett, Clayton A \*Taylor, Theodore F

# ALTADENA

Kellogg, Wm. Crowe Laurie, Frank C. Toor, F. N.

# AL TAHOE

Nazarek, Eugene A.

ALTURAS

Other Koza, Donald G.

AMBOY

California Salt Co. Mitterer, Adolph V.

ANAHEIM

Hoffman, Stanley A. Squibb, H. David

ANGELS CAMP

Other Crosgrave, David E.

ARCADIA

Bailly Engineering Enter.

\*Bailly Florent H. Other Coffey, Robert C. Dodds, Arnot W.

ARCATA

City of Arcata \*Kraus, Howard G.

ATHERTON

Stanford Rezearch Inst \*Hill, Myron Donald

AUBURN

J. N. Andregg

\*Andregg, John N.
Self Employed

\*Radley, Otto G.

\*Wilmoth, Floyd T. Other \*Webster, B. F., Jr.

# BAKERSFIELD

Kern County Land Co. Longshore, Charles T. Reim, Kenneth M. Wise Geophys. Service \*Wise, Fred G. Self Employed

\*Manning, John C. Oth McDonald, J. A.

BANNING

Other Allen, Roy H.

BELMONT

Self Employed
\*Benham, Jack L. Other Edmunds, James

# BELVEDERE

Robert E. Crockett
\*Crockett, Robert E.

# BENICIA

Yuba Consol. Ind., Inc. Carlson, Clarence G. Thiessen, John J.

#### BERKELEY

Bank of America

\*Hardin, Donald C., Jr.
Chain Belt Co.

\*Collins, James E. Chain Belt Co.

\*Collins, James E.
Inde. Mining & Milling Co.
Golson, B. E.
H. C. Macaulay Foundry Co.
Bair, Burdette D.
Univ. of California
Bowden, Robert M.

\*Cochran, George R., Jr.

\*Fuerstenau, Douglas W.
Goldstein, Norman E.
Hawkes, H. E.

\*Mero, John L.

\*Ravitz, S. Frederick
Shaffer, Lysle E.

\*Swersey, Richard J.
Trask, Parker D.

\*Ward, Stanley H.

\*Wittenberg, Howard E., Jr.

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\*Wollenberg, H. A. Self Employed Berkefeld, Paul C. Clausen, Ervin H. \*Donaldson, Wilfrid G. \*Fowler, Hedley S. \*Marcellus, Roy C. Stewart, Thomas A. \*White, Lloyd C. Other

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Meyer, Charles
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Pilcher, S. H.
Pruyn, John F.
Strobel, Landon F.
Way, Herbert F.
Youtz, Ralph B.

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Other
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Boyd, Robert R.
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Devitt, William J.
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\*Buchholtz, Herbert F.
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\*Wyman, Donald J.
Other Other Kunkel, Clair M. Miller, Robert L.

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\*Smith, Kenneth A. Other Moore, Frank C., Jr.

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Reno, Chales W.
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# Other Larsen, Herbert F.

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Northop, Inc. DiGregorio, Vincent

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Merrill W. MacAfee, ConsultEngr., Inc.
"MacAfee, Merrill W.

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Maltzahn, D. W.

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\*MacLeod, Norman A. Other Worthen, A. L., Jr.

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# LAKEWOOD

Other Graves, C. E., Jr.

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Other Fleming, Allen

# LAYTONVILLE

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Coast Mfg. & Supply Co.
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\*Lorber, Harvey R.
\*Rabb, David D. Other Wooster, David I.

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Other Other Marquand A. Bruce Tierney, Michael P.

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"Hoylman, H. Wayne
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Dunn, Parker S. Dunn, Parker S.
Dunn, Parker S.
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Arizona Metals Co.
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Chemical Mfg. Co. Inc.
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Novotny, Stephen T. Novotny, Stephen T.
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Grant, Mostyn G.
Hansen, James G.
"Hendricks, Robert J.
Mydd Henry. T.

Grans,
Hansen, James
\*Hendricks, Robert J.
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Rundle, William J.
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Newth, Richard C.
Diamond Tool Research
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\*Thomsen, Bert w.
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\*Grindell, Lionel N.
U. S. Pumice Supply C.
\*Reldon P.
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\*I. S. Pumice Supply C.
\*Reldon P. Swerdloff, Eli J.
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Stockton, Robert J.

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Moore, Arthur G.
"Nichols, Norman M.
B. F. Goodrich Ind. Prod.
Reagan, Donald W.
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"Schirm. John S.

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\*Schirm, John S.
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Mobil Oil Co.
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Mobil Oil Co.
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New World Exploration Sur-

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\*Nilsson, George W.
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Sill Labs.

\*Morgan, Harry J.

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Sill Labs.
"Morgan, Harry J.
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Dwyer, John E.
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"Kennard, Max J.
"Lentz, Rolf H.
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Southwestern Portland ment Co.
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State of Calif.
"Baily. Robert D.

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State of Calif.

"Baily, Robert D.
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Thor Power Tool Co.
Hunn, W. B.
Sandvig, Robt. L.
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"Snyder, Blanchard M.
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"Hersey, Lynn
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Smith, Joe P.
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Davidson, Erwin R.
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"Siegfried, J. F.
Todd, Wallace
Other Other Billick, D. C. Simkins, William A.

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Crocker Anglo Natl. Bank
"Charles, Abbott
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Glenn, George G.
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Bingham Clarence P.
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Ready, Thomas J., Jr.
"Schaffer, James W.
Woodman, William R.
Kaiser, Engrs.
Bates, Ralph G.
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Conwell, James A.
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"Roe. Joseph T.
"Suizbach, John E.
"Thompson, James V.
"Wallach, Albert A.
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"Cole, John Y., Jr.
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Kaiser Refractories
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Slade, Woodrow W.
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"Conrad, Ralph M.
"Daily, Arthur B.
Other
Canfield, George H.
Johansson, B. J.

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Johansson, B. J.
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Murray, Gilman Y.

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\*Manning, Paul D. V.

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\*Holman, Joseph R.

Jet Propulsion Lab.

\*Frink, Ellis P.

United Geophysical Co.

Blackie, Benson D.

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Self Employed
Edwards, M. Guy
Holman, Marshall G.
\*Noble, James A.
\*Potter, C. C., Jr.
\*Ratcliffe, Geo L.
\*Simmons, Edward E., Jr.
Six, Clarence W.
Tally, Robert E.
Other Other Lindvall, Charles E. Myers, Desaix B. Tepel, Robert E.

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# PEDRO VALLEY

Other Connell, Edw. J. O.

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Self Employed Hale, Elwyn C. \*Heidenreich, W. Lee Other
Borden, G. S.
Dorsh, John B.
Love, Colin L.
Vogt, Ernest A.

# PINE GROVE

Other Banks, Leon M.

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Other Pickering, Joseph

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Bobzien, Donald W. Fraps, Conrad L.

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Other Barneyback, Robt. S.

Pomona Tile Mfg. Co. \*Hamner, Jordan A. Other Allen, Harry P.

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Winsor, Donald K.
U. S. Bureau Land Mmgt.
\*Nielsen, G. W.
Self Employed
\*Murphy, John X.
Walker, Woodville J.
Other

Imswiler, J. Bruce Klitz, Alton E.

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# REDONDO BEACH

Smith, Frank T. A.

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Huseby, Juel G. Other Cheavens, John H.

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Nalle, Peter B.
Tuttle, Jay III
Walls, Marion B.
Weeks, LeRoy Wm.
Wightman, Randall H.
Utah Construction & Mining
Co. Co. Hubert, Joseph P. Oth

Gustafson, R. A. McCormick, Earl L. Mills, Eugene A. Szmyd, Theodore M. Thomas, Geo. G. Thorne, Thomas

#### ROLLING HILLS

Lewis, Albert L. Pett, Ray W.

# ROSEVILLE

Electro-Nuclear Metals, Inc. \*Day, Byron \$.

#### ROSSMOOR

U. S. Army Thompson, Maynard B.

## SACRAMENTO

Aerojet General Corp. Friedman, Lawrence M. Sheppard, Ben L. Calif. Dept. of Water Sheppard, Ben L.
Calif. Dept. of Water
Resources
Dettman, Steven S.
Calif. Div. of Mines
Clark, William B.
Natomas Co.
Smith, Richard G.
M. D. Rombough Lab.
"Rombough, Miles D.
Scandia Mines
"Rombough, Miles D.
Scandia Mines R.
U.S. Army Engr. Dist.
"Sheffield, Douglas A.
U.S. Bureau of Land
Management
Scarfe, George O., Jr.
"Sharp, Alan A.
Zentner, Lewis S.
J. H. Wren & Co.
Wren, Jas. H.
Self Employed
"Ash, Simon H.
Gilmore, Charles L.
"Logan, Clarence A.
Other
"Burgess. Robert J.

\*Logan, Clarence A.
Other

\*Burgess, Robert J.
Cartwright, Vern Wm.
Currie, Robert A.
Gerling, R. W.
Haines, Wilbur H.
Johnson, H. H.
Schnaible, Dean R.
Taylor, G. Cleve
Williams, George T.

# ST. HELENA

Self Employed
\*Jackson, Thomas A.

# SALINAS

Kaiser Alum. & Chem. Corp. \*Bowman, Jan Other Dante, Richard E.

# SAN ANDREAS

Calaveras Cement Co. Alisman, Lewis S. \*Bagley, Earle M., Jr. \*Hall, Evan E. James, John W. Fowell, James C. Weeks, Orrin D. Other Andersen, Edgar F. Fisher, Robert B. Fuller, W. P., Jr.

# SAN BERNARDINO

B.D.H. Co. Hudson, William Thomas Other Brewer, Howland S. Joyce, John E.

# SAN BRUNO

Other Proctor, John

# California-California

# SAN CARLOS

Atlas Copco Inc.
\*Day, Thomas Woody
Willener, Charles L., Jr.
Western Machinery Co.
Saarinen, Armas J. Oth Hilton, Charles R.

# SAN CLEMENTE

her Holt, Grover J. Johnson, James R.

# SAN DIEGO

Am. Pac. Mineral Exploration, Inc.

"Hart, Wood E.
San Diego State College
"Roberts, Ellis E.
"Thomas, Blakemore E.
Univ. of San Diego
"Phillips, Richard P.
Other Other
Brooks, Robert R.
Kline, James A.
Marcy, Frank E.

# SAN FRANCISCO

Allis-Chalmers
Clasen, Dann S.
Croft, Norton Evans
Amer. Exploration & Ming.

Goudey, Hatfield
Scholz, Edgar A.
Guy F. Atkinson Co.
\*Morrison, J. B.
James S. Baker Co.
Baker, James S.
Barber-Greene
"Taylor, William F.
Bechtel Corp.
"Bjorklund, Geo. K.
Dor, Abraham
Dungan, Theodore A.
"Hewitt, Robert S.
"Ives, King H.
"Johnson, Earl R.
"Merritt, William L.
"Russell, G. Raymond
Schnaible, Robert A.
"Taylor, Allan D.
Bethlehem Steel Co.
Hurst, George P.
Borcherdt, Edward R.
Bradley Mining Co.
"Bradley, James P.
Bradley & Ekstrom, Inc.
Helmke, R. F.
Bucyrus-Erie Co.
Sackett, Jack H.
Bunker Hill Co.
McRae, Robert J.
Calaveras Cement Co.
Casey, James R.
Duling, Orten E.
Mein, Gardner W.
Mein, Wm. Wallace, Jr.
"Metzger, Grant W.
Richardson, Wm. O.
Calco Supply
Woodward, Bert
Calif. Div. of Ind. Safety
"Francy, Henry J.
"Franz, John C.
Smith, Emory
Calif. Div. of Mines
Burnett, John L.
Campbell, Ian
Chesterman, Charles W.
Davis, Fenelon F.
"Gary, George L.
McNitt, James R.
Oakeshott, Gordon B.
Stewart, Richard M.
Ver Planck, William E.
Calif., State of
Lutz, Kyle J.
Nichols, Clifford R.
Chuck Boy Mine
Solari, Charles J.
Commercial Minerals Co.
Stewart, Richard M.
Ver Planck, William E.
Calif., State of
Lutz, Kyle J.
Nichols, Clifford R.
Chuck Boy Mine
Solari, Charles J.
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Ver Planck, William E.
Calif., State of
Lutz, Kyle J.
Nichols, Clifford R.
Chuck Boy Mine
Solari, Charles J.
Commercial Minerals Co.
Stewart, Malcolm
Cons. Purch. & Designing, Inc.
"Brinkman, Paul A.
Commercial Minerals Co.
Stewart, Malcolm
Cons. Purch. & Designing, Inc.
"Brinkman, Paul A.
Commercial Minerals Co.
Stewart, Charles J.
Commercial Minerals Co.
Stewart, Richard M.
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Commercial Minerals Co.
Stewart, Richard M.
Ver Planck, William E.
Calif., State of
Lutz, Kyle J.
Nichols, Clifford R.
Chuck Boy Mine
Solari, Charles M.
Eng

# California-California

Goldfield, Cons. Mines Co. Higginsbotham, T. S.

Goldfield, Cons. Mines Co. Higginsbotham, T. S. Glover Assoc.

\*Richardson, James K. Gordon, I. Gould & Co. \*Fopp, Silvio M. \*Gould, Gordon I. H. W. Gould & Co. \*Gould, Malcolm B. Abbott A. Hanks, Inc. Lurie, Herbert D. \*Taylor, Charles J. Hardings Co., Inc. Nolan, Charles Co., Inc. Nolan, Charles Co., Trescher, F. George Whisenant, Robert N. Hewitt-Robins, Inc. Crow, Wallis H. Zinter, T. C. Homestake Ming. Co. Bjorge, Guy N., Gustafson, John K. Henshaw, Paul C. McLaughlin, Donald H. Shoemaker, A. H. Stoehr, Richard J. Honolulu Oil Corp. Waldner, Clarence E. F. Houghton & Co.

Stochn, Richard J.
Honolulu Oil Corp.
Waldner, Clarence E.
E. F. Houghton & Co.
Vieira, Joseph L.
Ingersoll-Rand Co.
Cherry, Ned D.
Lang, Henry A.
Jacobs, J. Donovan
Joy Mfg. Co.
Rhodes, L. C.
Torpey, Herbert D.
Kern County Land Co.
Griswold, William T.
Arthur D. Little, Inc.
"Watson, William I.
Thomas T. Lunde, Inc.
Leroy, Alfred J.
Marcona Mining Co.
Herkenhoff, Earl C.
Miller, James R.
Nelson, William B.
"Sheppard, John J.
McCreary-Koretsky
Engineers
"Knaus, Charles L.
The Merrill Co.
Merrill, John L.
Metallurgical Lab.
"Quist, Martin P.
Mine Safety Appliances Co.
Butler, Kenneth S.
Mines Engrg. & Equip. Co.
Monte Verda, Bernard
Mining World
"Bogert, John R.

Mining World

\*Bogert, John R.

\*Grundstedt, Henry G.

"Grundstedt, Henry G.
The Mt. Copper Co. Ltd.
Kett, Laurence T. T.
Edward J. Nell Co.
Mitchell-Roberts, J. F.
James A. Nissen Co.
\*Nissen, James A.

Nordberg Mfg. Co. \*Makholm, Leonard O. Propp, H. N. Okinawa Engr. Dist.
Newson, John H.
Pacific Cement & Aggregates,

Hampton, George F. Howard, Edward L., & Kinzie, Robert A., Jr. Pearson, John L. Sanford, Lester F.

Pacific Coast Co.
\*Rust, George W.

Perini Corp. Davis, Charles S. wertherm Equip. Co. Krisher, Edward A., III

Krisher, Edward A., III
Sabin Engrs.

Sabin, Alfred B.
San Luis Mining Co.
Swent, J. W.
Shell Chemical Co.

\*Mills, Gerald J.
Southern Pacific Land Co.

\*Anderson, Kenneth E.

\*Cooksley, James W.

\*Danehy, Edward A.

\*Dorsey, Robert R.

Gardner, Murray C.

\*McCulloch, William C.

\*Oesterling, William A.

\*Papke, Keith G.

Wright, Lawrence B.

Sutro & Co.

Surro & Co.
Morrison, Peter
Thurman & Wright
\*Thurman, Charles H.
Traylor Eng. & Mfg.
Greef, Edward B.
Troian Power Co. Trojan Power Co.

\*Knowles, Charles E.

\*Smith, John H.

U. S. Air Force
McCarthy, Frank J.
U. S. Army
"Eddelman, Wm. S., Jr.
"Jones, David
Peshkoff, Viacheslav C.
U. S. Burcau of Mines
"Davis, L. E.
Dletrich, Waldemar F.
Hall, Robert
Holmes, George H., Jr.
Maurer, R. B.
Padan, John W.
U. S. Forest Service
Biodget, David P.
Gould, Gerald E.
Johnson, William L.
Sanborn, William C.
U. S. Navy
Bonham, Paul W.
"Hoskins, Earl R.
U. S. Sec. & Exchange Comm.
Dougherty, Elisworth Y.
U. S. Steel Corp.

"Hoskins, Earl R.
U. S. Sec. & Exchange Com
Dougherty, Ellsworth Y.
U. S. Steel Corp.
Henderson, Ashland S.
Birk, Jack N.
Casburn, William J.
'Hamilton, Walter A.
Johnson, Vard H.
'Jones, R. H. B.
Mote, Karl W.
Price, Charles F. B., Jr.
Pruden, Worrell F.
Sargis, Samson G.
Scheble, Max C.
Scott, W. Kenneth
Talbot, Robert C.
Universal Silvers Co.
Mowry, Allen G.
Utah Construction Co.
Allen, Eugene S.
Anderson, J. S.
'Bourret, Weston
Christensen, Allen D.
DeMoss, Edwin C.
Evans, Hugh W.
Goodwin, J. Grant
'Greenlee, B. B.
Hansen, Don A.
Hunt, Rodney H.
Kundert, Charles J.
Littlefield, Edmund W.
Lowell, J. David
"McArthur, Charles K.
McGraw, Charles L.
Welkay, Cameron E.
Phebus, James E.
"Quine, A. V.
Riddell, Paul A.
Wallace, Keith G.
Utah International, Inc.
'Pollin, W. J.
Western Knapp Engrg, Co.
'Andrewson, Charles H.
'Artam, Michael T.
Clark, Henry L.
Engel, Robert F.

\*Artam, Michael T.
Clark, Henry L.
Engel, Robert F.
\*Fulmer, J. W.
Haddon, William F.
Hansen, Robert M.
\*Jensen, James H.
\*Jensen, James H.

\*Fullner, v. Haddon, William F. Hansen, Robert M. 
\*Jensen, James H. 
\*Johnson, Robert N. 
\*Johnson, Robert N. 
Lambrev, D. Ivan McNeil, Harold J. 
O'Brien, Daniel E. 
Peacock, Hollis G. 
\*Raring, Robert H. 
\*Riethmeier, Walter 
\*Samuelson, Bengt A. 
Skinner, Charles F. 
Yestern Machinery Co. 
Bailey, Robert S. 
Byler, Raymond E. 
Clayberg, Geo. A. 
\*Cofield, Gordon E. 
Damon, N. C. 
Felsch, Hans J. 
Golson, Charles E. 
Hamm, John P. 
Hill, Jack V. 
How, Jack H. 
Jarpe, Gunnar E. 
Jenkinson, Donald W. 
\*Kranick, Cyril R. 
Mayer, Herbert J. 
Michaely, William D. 
\*Mueller, Jerry K. 
Mulcaby, P. H. 
Newton, Douglas E. 
Newton, Wm. H. 
Pugliese, Louis T. 
\*Reck, William H. 
Regh, John L. 
Springston, David L. 
Stewart, Thomas G. 
Wharton, Bruce A. 
Western Mineral Assoc. 
\*Brooke, J. K. 
\*Dreyer, Robert M. 
J. G. White Engrg. Co. 
Cowley, John F. 
Wisser & Cox 
\*Cox, Manning W. 
Lindsey, Eugene H.

Cox, Manning W. Lindsey, Eugene H.

\*Wisser, Edward H.
Worthington Corp.
Danver, W. E.
San Francisco APO
Bergman, Sheldon C.
\*Pressler, Jean W.
Sibray, Donald L.
Stoiser, Lee R.
Self Employed
\*Atkinson, James E.
Caglieri, Guido E., Jr.
Carlisle, Henry C.
\*Frederick, Francis H.
\*Gould, Bruce A.

\*Frederick, Francis H.
\*Gould, Bruce A.
\*Hecht, Arthur S.
\*Hughes, Arthur D.
\*Joralemon, Ira B.
\*Joralemon, Peter
\*McNell, Clayton T.
\*McShane, Oscar T.
\*Parsons, Lewis A.
\*Peale, Rodgers
\*Rawlings, Stuart L., Jr.
\*Stronck, H. N.
\*Wilson, L. Kenneth
\*Witt, Herbert N.
ther

her
Bartlett, A. G., III
Bloom, Edward J.
Bonham, H. F., Jr.
Butterworth, E. M.
Byram, Herbert F.
Carleton, Kirkendall
Chamberlin, R. A.
Doyle, Walter J.
Gerlach, Keith H.
Griggs, William S.
Hammon, Wendell C.
Joffe, Gerardo Hammon, Wendell C Joffe, Gerardo Laird, Thomas B. Levensaler, Lewis A. Lewis, J. Voiney Mac Nichol, A. W. Morbid, R. M. Morbid, Carlo S. Pett, L. Fern Pierce, Bruce Russell, J. K. Short, Maynard P. Sobel, Harvey L. Tempest, R. B., Jr. "Thompson, Thomas" Thompson, Thor Varney, F. W.

SAN GARRIEL

Self Employed \*Heron, Charles M. Other Mulock, Fred S.

SAN JOSE

SAN JOSE

Ac'cent Inter.
Arend, Carl A., Jr.
Allied Geophysics

\*Rose, R. Burton
Food Mach'y. & Chem. Corp.

\*Barnwell, Lloyd R.
Philbrook, Warren R.
General Electric
Megerth, Frederic H.
McKinney Assoc.

\*Barquist, William S.
Seif Employed

\*Riley, Thomas H.
Other

Binsacca, William A \*Hanson, Norman E. \*Hutton, Wm. A. Ternahan, J. C., Jr.

SAN LUIS OBISPO

Madonna Construction Co. Collord, James E.

SAN MARINO

Other Loel, Wayne

SAN MATEO

The Eimco Corp.
Schepman, Berne A.
Walsh Construction Co.
Schwyn, Richard B.
Self Employed
\*Kivari, Arthur M.
\*Stickney, Alfred W.
Other. Burmester, L. R. Fee, Ronald S. Gunther, Donald R. Jourbert, Louis J.

SAN PEDRO

Dalton, Robert J. Richardson, J. B.

SAN RAFAEL

Harding Assoc.
\*Cutmore, Vincent D.

Standard Oil Co. of Calif.

\*Cadle, Austin
Western Exploration Co.

\*Mitchell, Miles J. Other

Dunster, Carl B. Mull, J. B.

SANTA ANA

Orange Co. Flood Control \*Fiske, Richard J.

SANTA BARBARA

Great Lakes Carbon Corp.
Stone, Wm. D.
U. S. Geol. Survey
Miller, Glen A.
Self Employed
\*Tillia, H. J.
Other
Adams, Henry F.
Easton, Stanly A.

SANTA CLARA

Explosive Technology \*Huber, George B.

SANTA CRUZ

Brown, Walter F. Foust, Barney A.

SANTA MARIA

Great Lakes Carbon Co. Reinhart, Jack W. Other \*MacMillan, R. S.

SANTA MONICA

Geodynamics, Inc.

\*Freeman, Gerald W.

\*Pruss, Donald E.
Santa Monica City College
\*Lee, Charles A.
Self Employed

\*Patchick, Paul F. Other Driscoll, Robt. Edw.

SANTA ROSA

City of Santa Rosa Gibson, James Other Barker, Lyle M.

SARATOGA

Pick Mining Co.
Pick, Vernon J.
Tripp Research Corp.
\*Tripp, R. Maurice ner Barton, Thomas V. Hammon, Wendell P.

SAUSALITO

E. D. Bullard Co. Bullard, Edward W. The Taylor-Knapp Co. \*Knaebel, Charles P. Self Employed
\*Hawley, Edwin E.

SEBASTOPOL

Self Employed Schuette, Curt N.

SELBY

Amer. Smelt. & Refin. Co. Playter, George H. Other \*Reid, W. Spencer

SELMA

Other Iwamura, Thomas

SHINGLE SPRINGS

El Dorado Limestone Co. Stinson, W. A., Jr.

SHOSHONE

Sierra Talc Co. Kempfer, Donald B.

SIMA

Other Silva, Jay F. SONORA

Other Lewis, Allen

SOUTH GATE

Fibreboard Paper Prod. Hillmer, Roy W.

SOUTH LAGUNA

Shell Oil Co. \*Robertson, Glenn D. Other Harris, Derek T.

SOUTH PASADENA

Sierra Talc & Clay Co., Inc. Booth, Otis Mulryan, Henry Mulryan, James D. Other \*Reis, James W.

SO. SAN FRANCISCO

Alimax Corp.

Borgenhard, Jan O.

Edgerley, James D.

STANFORD

Standford Univ. \*Just, Evan Niedermeyer, Oscar David, Jr. Park, Charles F., Jr. \*Parks, Geo. A.
Self Employed
\*Taylor, Charles M. Other Cameron, William L. Sandvik, Peter O.

STOCKTON

Jefferson Lake Asbestos Corp.

\*Prince, Robert William
Stockton School Dist.
Beck, Edwin L.
Whittaker Iron Mines
Whittaker, Norman A.

SUNNYVALE

Lockheed MSD Sprague, William E.
Other
Farley, Eldon P.
Whipple, Ross W.

SUSANVILLE

Lassen U. H. & Jr. Coll. \*Valov, Igor

SUTTER CREEK

Calaveras Cement Co.
\*Slater, T. Calvert

TARZANA

Other Weisenburg, L. E.

TIBURON

Britt & Assoc.
\*Googin, Thomas M.

TRABUCO CANYON

California Non-Metallica \*Ellerman, Otto M.

TREASURE ISLAND

U. S. Naval Stat. Public Works Dept. Mrock, John W.

TRONA

Amer. Potash & Chem. Corp. Berthold, Cornelius E. Rockdale, Lloyd H. Self Employed
\*Darrow, Frank M. Other Modesto, L. Leonardi

UNION CITY

Amer. Forge Co. Coleman, Charles A.

VALLEJO

Vallejo Junior Coll.

\*Goff, Ernest A., Jr.

VALLEY CENTER

Self Employed Tizard, William E.

VANDENBERG AIR FORCE BASE

Lockheed Aircraft Corp. Knudsen, Walter I., Jr.

VAN NUVS

Other Messer, Lisle R.

VENTURA

Martin, Robert E.

VICTORVILLE

outhwestern Portland Cement Co.
Barclay, A. H., Jr.

\*MacIver, Douglas Y.
Victorville Lime Rock C

\*Ball, Emmett B., Jr.

\*Gessner, Robert H.

\*Hare, Charles E. Co.

VISALIA

Other Harrell, W. H.

WALNUT CREEK

Bird Machine Co Bird Machine Co.
Burns, Thomas E.
Self Employed
\*Pesonen, Paul E. Rogers, John M. Winter, Walter A.

WALTERIA

Great Lakes Carbon Corp. Dyrsmid, Dalibor Francis

WEST COVINA

Kennedy Minerals Co. Inc. Kennedy, John J.

\*Brown, Meredith C.
\*Cullity, Emmet R.
\*Lowe, John P.
\*Waite, Harold A.

Other Angst, Harry H. Clark, Ronald W Obert, L. R.

COG Min. Co. \*Hanson, Frederic D.

WOODLEAF

Oroville Project Contractors Lindquist, John T.

# COLORADO

ARVADA

Bear Creek Min. Co. Strangway, David W. Blue River Constrs. \*Adams, Theodore F. \*Adams, Theodore F.
Mine & Smelter Supply Co.
Shiell, Arlou E.
Lee Morse Co.
Arentzen, Leif E.
U. S. Bur. of Mines
Romslo, Thomas M. Other Smith, P. R. Vanecek, Frank R.

Self Employed \*Anderson, Francis W. Other Dodge, James S.

AURORA

Other Bennett, J. Gordon

BOULDER

Allied Chem. Corp.
Allen, Glenn E.
Crystal Mining & Engrg.
Swerdfeger, Richard M.

LaSalle Min. Co.
Rummel, C. Thomas
Univ. of Colo.
\*Peiker, Edwin W., Jr.
Williamson Mining Co.
Williamson, Harry B.
Self Employed
\*Cobb, Harrison S.
\*Johnson, Arthur F.
Other

"Johnson, Arthur F.
Other
"Conrad, P. P.
Erti, Tell
Sterling, Robert
Teal, George H.
Waters, Thomas E.

BROOMFIELD HGTS

Other Kautz, Harry P.

BUENA VISTA

Other Walker, Marvin S.

CANON CITY

Cotter Corp.
Goff, Warren E.
Hanson, Glen E.
Marcott, David P. Other Jordan, G. Robert Ulmer, Joseph

CARBONDALE

Mid Continent Coal & Coke Co.
Reeves, John A.
Turner, John H.
Thompson Creek Coal & Coke
\*Abel, John F., Jr.

CLIMAX

Amer. Met. Climax
Achttien, Donald B.
Allen, W. Raymond
Baker, Richard C.
Barnett, Ralph M.
Bauhan, Hobart B.
Bender, Frederick N.
Burk, Snell G.
Cleeves, Charles A.
Distler, William F.
Drechsier, Herbert D.
Eisenach, Edwin J.
Foster, B. R.
Gott, Richard D.
Gragory, William J.
Gregory, William J.
Grossman, Eugene L.
Hamman, Jack A.
Harelson, Wm. Henry
Henderson, Robert
Hoff, Fred J.
Hoffman, Clarence W.
Jonson, David Carl
Julin, Douglas E.
MacKenzie, W. Bruce
Miller, Reed M.
Powell, J. W.
Richards, John T.
Rist, Karsten A.
Smith, Albert K.
Sundstrom, Marvin R.
Ward, Albert E.
Windolph, Frank J.
her
Craig, Robert
Huston, Marvin R.

ter Craig, Robert Huston, Richard C. Wallace, Stewart R.

COLLBRAN

Other Gammel, Robert M.

COLORADO SPRINGS

Golden Cycle Corp.
Ballard, Thomas J.
\*Bowen, Max W.
Murray, George
\*Welch, Wm. R.
Stratton CCM & D Co.
\*Keener, James H.
Self Employed
\*Adams, Sidney F.
Other

Other Griesemer, F. J. Ruder, Ralph E.

CORTEZ

Other Witt, Wilmer H.

Self Employed
\*Stewart, H. V.

CRESTED BUTTE

Amer. Smelting & Ref. Co. Probst, Nolan

DENVER

DENVER

A. A. Engrs. & Assoc.

"Gaz, Louis A.
Air Rentals Inc.
Pearson, Robert H.
Allis-Chalmers Mfg. Co.
Moody, Richard D.
Amer. Brake Shoe Co.
Bauman, Harry C.
American Manganese Steel
Ross, Pat L.
Amer. Metal Climax Inc.
Meyer, P. A.
Moore, Thomas G.
Rostad, Ora H.
Amer. Smelt. & Ref. Co.
Anderson, George W.
Atlas Copco Inc.
Averili, Kenneth M.
"Hohler, Gordon D.
Bail Assoc.
"Bail Douglas

"Hohler, Gordon D.
Ball Assoc.
"Ball, Douglas
Bear Creek Mining Co.
Anzman, Joseph R.
Gilbert, Ray E.
Holmer, Ralph C.
Regan, M. Daniel
Rogers, George R.
Shepard, William M.
Wargo, Joseph G.
Camp Bird Colo. Inc.
Tremlett, C. P.
C. S. Card, David C.
Waver, Robert G.
J. C. Carlile Corp.
"Carlile, Jessie C.
Waver, Robert G.
J. C. Carlile, Jessie C.
Entury Geophys. Corp.
"Nicol, Archie J.
Chicago Pneu. Tool Co.
Briggs, Orval Lon
Climax Molybdenum Co.
Norman, Telfer E.
Colo. Bureau of Mines
"Cole, David R.
Franz, Gustav Alfred
Colorado Fuel & Iron Corp.
Bourne, Robert F.
Crow, Walter L.
Schmuck, Howard K., Jr.
Scott, Richard Lee
Siljestrom, D. R.
Wilson, Malcolm E.
Colorado Min, Assoc.
Palmer, Robert S.
Congdon & Carey
Congdon, Thomas E.
Contract Engineering Co.
Goddard, P. L.
"Hoyl, Alfred G.
Cooper Quarries
"Cooper, Earl M.
Crucible Steel Co. of Amer.
Stark, Robert L.
Denver Equipment Co.
Ahlborg, William T.
Flagg, Richard W.
"Gisler, Henry J.
Johnson, Clyde V.
Litz, Deil E.
"Logue, Leland H.
Seeton, Frank A.
Shoemaker, Jay C.
"Thom, Clarence
"Wentworth, William
"Wick, Keith E.
Denver Fire Clay Co.
"Brandt, Wm. O.
Edward D. Dickerman
"Dickerman, Edward D.
E. I. du Pont de Nemours &
Co. Inc.
Campbell, Dolph
Lydn Meivin

Co. Inc.
Campbell, Dolph
Irvin, Melvin
\*Summer, Raymond H.
Emperius Mining Co.
\*Poxson, B. T.
Equipment Specialties Ce.
Davidson, Paul G.
Falcon Air Maps Co.
Haymaker, Herbert E.
Four Corners Oil & Min. Co.
\*Clark, Henry D.
Wilfley, Clifford R.
Frontier Refining Co.
\*Parker, Ben H.
Gardner-Denver Co.
Alexander, Roy K.
Rapp, Arnold E.
General Electric Co.
\*Mehl, Clinton D.
Stevens, F. F.
Goble, Sampson & Smith Inc.
Collection of Control of Control of Control of Collection of

Goble, Sampson & Smith Inc. Smith, G. Richard Harnischfeger Corp. Sullivan, Ed. J.

California-Colorado E. K. Hartzell & Assoc.
 "Hartzell, Edson K.
Hercules Powder Co. Inc.
 "Persse, Franklin H.
Humphreys Engineering
 Allender, Robert M.
Ennis, Robert E.

Allender, Robert M.
Ennis, Robert E.
Humphreys, Ira B.
McKinley, Frank M.
Snedden, Henry D.
Humphreys Gold Corp.
How M. O.
Ideal Cement Co.
Douglas, Thos. B.
Matthews, M. O.
Ingersoll-Rand Co.
Harris, Frank B.
Pinkerton, Dale L.
Joy Mfg. Co.
Berthelote, Ted F.
Keuffel & Esser Co.
Sharps, Thomas I.
I. V. Korts
\*Korts, Ingraban V.
Martin Co.
Zimmerman, M. Jorda

Martin Co.

Zimmerman, M. Jordan
McGraw-Hill Publ. Co.
Patten, John W.
Meurer, Serafini & Meurer
Sluga, Thomas L.
Mine & Smelter Supply Co.
\*Drinkwater, Donald J.
Garbella, Elmer J.
Lippert, Wm. L.
Seep, Albert E.
Thompson, Charles F.
Min. Concentrates & Chem.
Co.

Co.

\*Johnston, Theodore L.

Ralph B. Moore Inc.

\*Moore, Ralph B.

Morse Bros. Machinery Co.

Cox, Buford B.

Grimes, Harold N.

National Fuse & Powder Co. Hill, A. Lefevre

Off. of Mineral Explor.
Connors, Hugh M.
Charles O. Parker & Co.
\*Parker, Charles O.

Patten Eng. Co. \*Patten, Asher H.

Potash Co. of America Coope, G. F. Prize Min. & Milling \*Russell, Donato L. Quad Constr. Inc. \*Haley, Fred S.

Haiey, Fred S.
Rio Grande Gravel Co.
Blose, M. Stanley
The Ruth Co.
"Ruth, Joseph P.

Schloss & Shubart
Schloss, Charles M., Sr.
Shelledy, Leo D.
Shubart, Stanley C.

Sneliedy, Stanley C.
Securities & Exch. Comm.
Higdon, Charles E.
Silver Bell Mines Co.
Sanders, Eugene H.
Silver Engineering Works Inc.
Price, Frank B.
Stearns-Roger Mig. Co.
Asel, Philip R.
Bernard, Frank S.
Becch, Chas. S.
Borasio, Leo
Breitling, Thomas O.
Coyle, Sam D.
Davidson, A. Jackson
Druva, Robert L.
Graeber, R. W.
Hester, Walter B.
Irwin, Bruce H.
Mathews, Harvey

Irwin, Bruce H.
Mathews, Harvey
McGrath, Maurice G.
McNeill, Harry L.
Monarchi, J. L.
Olson, Ralph B.
Sproul, Arch A.
Stryker, John R.
State of Colorado
\*Allen, Thomas
\*Clark, Edward L.
Strauss Enterprises Inc.
Freeman, Alva O.
Sun Oil Co.

Sun Oil Co. Justice, Philip S.

Susquehanna-Western Inc.

\*Bryant, Gerrett H.
Gray, Allen D.
Merwin, Stuart S.

Thompson Creek Coal & Coke Corp.

"Keenan, Albert M.
Tipton & Kalmbach Inc.
Duckworth, Maynard
Union Supply Co.
Hermann, Kenneth R.

California-Colorad
U. S. Bureau of Mines
\*Allaman, Paul L.
Bates, Robert C.
Boley, Charles C.
Boley, Charles C.
Bolmer, Robert L.
Geehan, Robert W.
Jolley, Theo. R.
Konselman, Albert S.
Minges, Ralph V.
Newcomb, Edward L.
Shannon, Spencer S., Jr.
Shaw, John F.
Utter, Stehen
Wilmot, Richard C.
"Winans, George D.
U. S. Foundries Inc.

U. S. Foundries Inc. \*Niemeyer, Ernest L.

\*Niemeyer, Ernest L.
U. S. Geological Survey
Brobst, Donald A.
Canney, Frank C.
Cooper, John R.
Emerick, William L.
Frischnecht, F. C.
Hernon, Robert M.
Huff, Lyman C.
King, Robert U.
Lindeman, Harold B.
Wayman, Cooper H.
Zablocki, Charles J.
W. Walvoord I.

W. Walvoord Inc.
\*Matthews, Christian W.
\*Walvoord, O. W.

Walbridge Co. Walbridge, Cecil R. Walbridge, Cecil R.
Western Mach. Co.
Jones, Leigh M.
Western Nuclear Inc.
Cenis, Donald L.
Roecker, F. W.
Thomas, Peter N.
A. R. Wilfley & Sons Inc.
Wilfley, Arthur R.
Wilfley, George M.

Wilfiey, Arthur R.
Wilfiey, George M.
Self Employed

\*Boos, Margaret F.
\*Campbell, Thomas P.
\*Carman, Katharine W.
\*Cazier, James H.
\*Cramer, William B.
\*DeSollar, Tenney C.
\*East, John H., Jr.
\*Fominyh, Michael P.
\*Harris, George R.
Mallery, H. W.
Morgan, Helena O.
\*Parker, Robert F.
\*Prommel, Harald W. C.
\*Ridland, G. Carman
\*Rigg, John B.
Ritter, Etienne A.
\*Spalding, Robert S.
\*Sweet, Arthur N.
\*Tedrow, Harvey L.
\*Thomas, C. Sewell
\*Thompson, Raymond M.
\*Twinem, Joseph Conrad
Other
Bailey, John E.

her
Bailey, John E.
Barker, C. L.
Beckman, Robert T.
Board, V. L.
Briber, Frank E.
Cannaday, F. X.
Corbett, Francis X.
Coulter, Harold B.
Daly, Thomas W.
Daman, Arthur C.
Dean, Walter J.
Denny, Edward H.

Dean, Walter J. Denny, Edward H. Donaghue, Conrad P. Dorward, H. M. Elsner, F. Robert Evans, J. Claire Fairchild, G. L. Frost Hildreth, I. Fairchild, G. L.
Froot, Hildreth, Jr.
Grove, Clark
Hodges, Wm. V.
Howes, Merwin H.
Jonnson, Oscar H.
Jones, William R.
Kleff, J. Marvin
Loenshal, H. K.
Martin, Victor R.
McMichael, H. J.
Melting, A. C.
Mosley, A. G.
Mosley, Herbert R.
Payne, W. L., Jr.
Phillips, Earl C.
Quinn, James E.
Ramsey, Elmer R.
Rieman, Cedric H.
Schapiro, Paul P.
Schipper, Warren B.
Stedman, Alan L.
Stockton, John D.
Studebaker, Jas. B.
Thomas, Lester C. Frost, Hildreth, Jr.

Thomas, Lester C. Vickers, Rollin C. Vogenthaler, Tho. J. Ward, John D. Ward, Joseph E.

# Colorado-Connecticut

Welker, Merrill Wigton, Paul L.

## DOVE CREEK

Union Carbide Nuclear Co. Bodell, William C.

Vanadium Corp. of Amer. Brinker, Fred A. \*Dickerman, Ed Day Edwards, Page L. Other erguson, John, Jr. Viles, Dennis W.

# EGNAR

Other Hankins, Terence J.

#### ENGLEWOOD

Dorr-Oliver Inc. Hughart, R. P. Steel Structures of Colo. Canning, Tom V. Vulcan Iron Works Co. Hawn, C. W. Other

her Bryant, Gerrett Dudgeon, James W. Gardner, Wm. C. Hyer, J. W., Jr. Jameson, J. G. Jameson, J. G. Jett, J. H. Robinson, Ernest G.

Imperial Coal Co. Gunther, Wilbur J.

### EVERGREEN

Betchart-Keck \*Betchart, Arthur F. Oth Haynes, Harry E. Sandifer, W. R., II

# FORT COLLINS

Ideal Cement Co. Howell, Donald H. Lauritsen, Don A. Wolfe, John A.

# FRISCO

Other Denison, David F.

# GEORGETOWN

Barodynamics Inc.

\*Livingston, Clifton W.
Waldron, Howard L.

N. J. Zinc Co.
Jude, William L.
Merchant, John S.
Painter, William H.
Sikkar, Johan
Stienmier, Harold
Walke, Raymond H.
Williams, William B.
Witthauer, Foster J.
Wood, Russell L.
Other

Other Brown, James M.

# GILSONITE

Amer. Gilsonite Co.
\*Diskin, Jack S.

# GLENWOOD SPRINGS

Thompson Creek Coal & Coke Corp.

\*Allan, Andrew Other Chandler, John M. Cross, Bertram J.

# GOLDEN

Climax Molybdenum Co.
Cuthbertson, Robert E.
Jones, Wm. E.
Colo. School of Mines
\*Ayler, Maynard F.
\*Badgley, Peter C.
\*Baxter, Robert A.
\*Bloom, Harold
\*Bryner, Leonid
\*Carpenter, Robert H.
Chapin, Charles E.
\*Crabtree, Edwin H.
\*Cruickshank, Michael J.
Davis, Franklin T.
\*Defoe, Michael E.

Drobnick, James L.

\*Fertig, Wendell W.

\*Frush, Charles O.

\*Grosvenor, Niles E.
Hendricks, Robert S.

\*Jaffe, Felix C.

\*Johnson, J. Harlan
King, Robert S.

\*Kuhn, Truman H.
Mariacher, Burt C.
Merritt, Robert C.

\*Perry, J. Kent

\*Rau, Earl L.

\*Reed, John J.

\*Rinehart, John S.

\*Smith, Fred L.

\*Svendaen, Paul V. H.

\*Vanderwitt, John W.

\*Young, Thomas R.

Coors Porcelain Co.

\*Lintner, Robert E.

Kerr-McGee Oil Industries
Henrickson, Angus V.

Meyer, Gene

Chas, Melbye & Assoc.

\*Melbye, Charles E.

Min. Indust. Engrs.

\*Coolbaugh, D. F.

Del Rio, Salvador M.

Self Employed

\*Bernstein, M. John

\*Hopkins, Paul M.

\*Parker, Ben H., Jr.

\*Short, Allan M.

\*Warren, S. Power

Other

Anderson, T. P.

\*Warren, S. Power ther Anderson, T. P. Bator, George T. 
\*Carpenter, Clark B. Clark, Franklin F. De Losada, Manuel Downey, Joseph Mar Galbraith, D. S. Hasler, J. William Haworth, David L. Haynes, C. V., Jr. Hersey, Gordon R. Jennings, R. W., Jr. Martin, Carl C. Mateer, W. D. Moston, Robert P. Seidel, Don C. Spence, Walter C. Weinig, Arthur J. Yingst, Parke O. Young, William E. Other

# GRAND JUNCTION

GRAND JUNCTION

Argo Mining Co.
Woodard, Frank E.
Beaver Mesa Uranium Inc.
Simpaon, Alan M.
Brophy Supply Co.
Brophy, Harry E.
Burgess Invest. Co.
Burgess, John C.
Calif. Oil Co.
Rankin, Rodney R.
Chapman & Morehouse Mining Co.
\*Chapman, John L.
Climax Uranium Co.
Donnerstag, Philip
Mastrovich, Anthony M.
Moore, Jack C.
Wire, Paul F.
Continental Materials Corp.
Reynolds, C. H.
Roscoe, John G.
Dulaney Mining Co.
\*MacPiaerson, Frank H.
\*Powers, Philip P.
Todd, William E.
Lance Explor. Engrg.
Campbell, Lyle F.
La Salle Mining Co.
\*Michell, John C.
\*Wein, Philip S.
Minerals Engineering Co.
Burwell, Blair
Sullivan, Raymond G.
Mitchell John C.
\*Mitchell, John C.
\*Soates, George K.
N. J. Zinc Co.
Hayes, Arnold Lee
Radabaugh, Robert E.
Spalding, Edward C.
Pacific & Western Supply
Inc.
\*Munro, John T.
Roberts & Assoc.

Pacific & Western
Inc.
"Munro, John T.
Roberts & Assoc.
Redmond, Robert L.
Shattuck Denn Mining Corp.
Appelin, Carl W.
Newell, Thomas W.
Sprague & Henwood Inc.
Carver, Robert R.
Richards, Jacques
Superior Oil Co.
Barnard, Ralph M.

Gjelsteen, Thor
Wilpolt, Ralph H.
Texas-Zinc Minerals Corp.
Bernholdt, Arthur G., Jr.
Dearth, Albert E.
Union Carbide Nuclear Co.
Bagan, Richard J.
Bebee, Alfred H., Jr.
Beverly, Robert G.
Bishop, Vernon J.
Brenton, J. F.
Criswell, Wilbur F.
Emerson, John F.
Hastings, James S.
Jackson, Harold K.
Kohler, W. H.
Lake, James L.
Lankenau, A. W.
Perry, Albert J.
Sada, Albert C.
Van Fleet, Thomas R.
Uranium Inst. of Amer.
"Weller, Gordon A.
Uranium Reduction Co.
Matsumoto, Tak.
U. S. Atomic Energy Comm.
Abramo, John M.
Barry, John G.
Barnes, John W.
"Barry, John G.
Bemis, Frank A.
"Blirk, Robert G.
Bowes, William A.
Blirk, Robert G.
Bowes, William C.
Crew, Merle E.
George, D'Arcy R.
"Happ, Stafford C.
Irving, Irving G.
Knowles, Paul H.
Mayer, Stanley A.
McGinley, Frank E.
Meek, Ward B.
"Mehan, Michael P.
Lekas, Mitchell A.
O'Rear, Neilsen B.
Philippone, Richard L.
Pickwick, Fred Jr.
"Prochnik, Martin
Rasor, Charles Alfred
Ritter, Gilman C.
Robinson, Zewis M.
Sayre, Robert H., Jr.
Smith, M. Clifford
Toole, Robert H.
Winn, Burdett A.
Youngberg, Elton A.
Charles V. Woodard & Co.
Woodard, Charles V.
Western Machinery Co.
Ferron, Robt. A.
Worcester Mines
Hil, John W.
Yubo Development Corp.
Maloit, Frank J.
Self Employed
"Cutter, Russell C.
"Mizelle, Ed. P.
"Nicholson, Dean
"Robeck, Raymond C.
"Shipman, Mark K.
Other

\*Nicholson, Dean
\*Robeck, Raymond C.
\*Shipman, Mark K.
Other
Archer, Bryan J.
Ary, T. S.
Baker, David D.
Beck, Richard H.
Boyd, A. F.
Brown, M. O.
Burnett, John T.
Counley, Richard T.
Cunningham, Wm. D.
Ferron, Robert A.
Fulton, David H.
Hill, Don R.
Hines, Alex E.
Hofman, D. E.
Holmes, Thomas W.
Hopkins, T. E.
Lawson, Theodore, J.
Lewis, Elbert E.
Morehouse, Geo. E.
Pinnick, Edgar K.
Poulos, James F.
Redman, Travis H.
Schumacher, John I.
Setter, A. George
Seymour, F. I.
Son, D. G.
Warner, Roland M.
Westbrook, James C.
Wittmeyer, W. W.
Wood, John A.

# GREELEY

McDay Co. McGlothlin, Wm. K.

# GUNNISON

Gunnison Mining Co. Robison, John L.

Pinnacle Exploration Inc. Dunn, James E. Self Employed Wilson, Thomas L.

# HOTCHKISS

Other Ellis, Scott

# IDAHO SPRINGS

Jack Pine Mining Co. \*Watrous, Douglas V. Other Kyler, George R.

#### LA JUNTA

City of La Junta Burrell, Gene A.

# LAKEWOOD

her Bank, Walter Chesebrough, S. A. Croy, Robert E. Foran, John F. Leckner, Glenn G. Masbruch, Arthur C. Soule, John H. Winters, Verne W.

# LEADVILLE

Emerald Isle
Kendrick, Robert
Triumph Gold Inc.
Kendrick, Frank E., Jr. Kendrick, Frank Other Meldrum, William B. Meyertons, Ralph P. Petty, John M. Shore, James L. Walde, Gordon H.

### LITTLETON

Ohio Oil Co.

\*Lickus, Robert J.
Pray, Lloyd C. Canning. T. V. Dickinson, George W. Olin, John R.

# LVONS

Other Matsen, Edward

# MAYBELL

Trace Elements Corp.
Gay, William D.
Sawyer, Carl W.
\*Thompson, Robert M.

# MONTROSE

Other Doyle, William R.

# NATURITA

Naturita Supply Co., Inc. \*Wenzel, Robt. O. Vanadium Corp. of Amer. Bischoff, Charles K.

Camp Bird Mine Bailey, Benton B. Ward, Mark L. Idarado Mining Co. Gunelson, Adolph G. Wise, John S.

# PALISADE

Other Carver, Archie L.

# PUEBLO

Colo. Fuel & Iron Corp.
Bertholf, William M.
Christy, Harold H.
Erickson, Reed G.
Frost, Clyde W.
Purdy, John R.
Schenler, William J.

Scheme, Other Blalock, Clovis C. Carter, David A. Jackson, R. A. Price, John D. \*Taylor, Leslie S.

# RICO

Rico Argentine Mining Co. Whitney, L. Earl

Union Carbide Nuclear Co. Hollingsworth, J. Stewart

Sanders, John P. Temple, Frank T. Other Strom, Elwood E

## SALIDA

Colo. Fuel & Iron Corp. Whitney, James E. Self Employed \*Burleson, Walter E.

# SILVER PLUME

Colombine Metals Inc.
\*McMillan, William D.

# SILVERTON

Standard Metals Corp. Elder, Robert L. Hunter, Edgar T. 'Hutchinson, David Other Andreatta, R. M. Bruchner, Gordon W.

# SLICK ROCK

Other Jones, Robert B.

# SOMERSET

Minerals Div. Corp. Nyman, Fritz

# TELLURIDE

Idarado Mining Co. Hilander, Arthur C. Other Kaattari, W. A. Saunders, James B.

# TIN CUP

Other Secton, Ross V., Jr.

# TIRAVAN

URAYAN
Union Carbide Nuclear Co.
Berkey, Wayne L.
Borden, James R.
Haubold, Niels B.
\*Heinz, John M.
\*Irvine, Gordon B.
\*Robbins, David A.
Sanders, Calvin C.
\*Thompson, Arthur C.
\*Younger, James A.
Other
Karinen, Bruce S.
Smith, Elvin W.
Swindle, Roger W.

# VICTOR

Golden Cycle Corp.

\*Carlton, Chas. H.

Klein, William C.

# WESTON

Colo. Fuel & Iron Corp. Ingles, Lloyd W.

# WHEATRIDGE

Self Employed
\*Gordon, Ernest R.

# CONNECTICUT

# ABINGTON

Other Mayer, Andrew

# BRIDGEPORT

Bridgeport Public Lib. Sohon, Julian A. Handy & Harman Leach, Robert H. Other Kravitz, Joseph H. Sohon, Robert S.

# BRYAM

Self Employed \*Twitchell, Karl S.

# DANBURY

American Cyanamid
Kaufman, David
Newmont Exploration Lid.
Beehaud, Lesile J., Jr.
Brant, Arthur A.
Christie, David John
Dolan, Wm. M.
Elliot, Charles L.
\*Hellyer Walter C.

# DARIEN

Self Employed
\*Furbank, Arthur W.

Other Falconer, Robert A. Griffin, Frank A. Hoyt, John Terrell

Essex Paint & Marine Co. Spencer, Elliot A., Jr.

GREENWICH

American Mach. & Frdy. Co. \*DeKønski, Leon M. Self Employed \*Nichols, Herbert L., Jr. \*Wormser, Felix Edgar Other

her Myers, John F. Snapp, John B. Townsend, Rex

HAMDEN

Other McGraw, Robert B., Jr. Milligan, Wm. E. Motock, Geo. Thomas

HAMPTON

Other Roberts, Newell W.

HARTFORD

Trinity College Berry, Richard W.

LAKEVILLE

Nutmeg Mining Corp. Levine, Arthur P. \*Testone, Taldino

Harding, James E.

MADISON

Shepherd, Owen

MERIDEN

Self Employed Egeberg, Birger

MIDDLETOWN

Wesleyan Univ. Peoples, J. W.

NEW CANAAN

Self Employed
\*Monroe, Eugene H. Other Caron, Peter E. Lourie, D. K. Roosevelt, Ralph M.

NEW HAVEN

The Box Shop, Inc.
Behre, Henry A.
A. N. Farnham Inc.
Kolb, Thomas T.
The New Haven Trap Rock WATERBURY The New Co.

\*McKeagney, Robert B.
Yale Univ.
Bateman, Alan M.
Cotton, John E.

\*Jense, Mead L.

Other Warner, Robert K.

NEW LONDON

Walter P. Jacob Industries WESTPORT Inc. Jacob, Walter P.

NORTON HEIGHTS

Neale, Walter G.

NO. STAMFORD

Other Terry, Arthur, Jr.

ORANGE

Self Employed Graton, Louis C. Other Chester, Paul L.

RIVERSIDE

Self Employed Walker, Godfrey B.

SHARON

Spencer, Frank N.

SIMSBURY

Ensign-Bickford Co. Carr, Barton W. Sherman, William S.

SPRINGDALE

Amer. Machine & Foundry Co. Hollander, Milton B.

STAMFORD

American Cyanamid Co.
Booth, Robert B.
Davis, Donald W.
Farwell, Fred W.
Freyberger, Wilfred L.
Hedley, Norman
Morton, Walter F.
Rothschild, Stanley
Tabachnick, Howard
Dorr-Oliver Inc.
Anable, Anthony
Barnebl, August C.
Clemens, Robert F.
Coope, George F., Jr.
Darby, George M.
Ekstrom, Glen O., Jr.
Eng, Philip B.
Graves, John T.
Grothe, John D.
Hall, Herbert W.
Hitch, Joseph D., Jr.
Hochscheld, R. E.
Marston, William Thomas
Mason, W. Clark

Hnch, Joseph D., Jr.
Hochscheid, R. E.
Marston, William Tho
Mason, W. Clark
McArdle, Robert J.
Michener, John W.
Munro, Neil
Nauta, Robin G.
Porter, Ed F.
Priestley, Robert J.
Roberts, Elliott J.
Schreiber, Charles A.
Stansmore, Keith C.
Thompson, Robert B.
Weber, Wm. C.
Westphal, Carl W.
Wilson, Glenn O.
Wilson, Glenn O.
Wilson, Peter C.
Woch, Thomas
Hewitt-Robins, Inc.
Goodyear, Austin

Hewitt-Robins, Inc.
Goodyear, Austin
Johnson, Raiph E.

Von Thaden, Haroid
U.S. Navy
Reese, Joseph O.
Other
Cadwell, Edw. P.
Dayton, H. Dayton
Lindstrom, K. C.
Maloney, J. J., Jr.
McLean, Daniel C.
Seif Employed Self Employed

\*McLeod, Bentley H.

STAFFORD SPRINGS

Linatex Corp. Crawford, Bruce D.

The Bristol Co.

\*Armstrong, Gerald C.
Heslin, Gerard M.

WEST HARTFORD

Univ. of Hartford Prud'homme, Hector C.

Dorr-Oliver Inc. Bosqui, Francis L. Oliver, Robert H. Wall, Clarence J. Baker, John A.
Foley, Rupert M.
Hitzrot, Henrey W.
Jukkola, W. W.
Mitchell, C. C., Jr.

WESTON

Other Bregy, Louis H. Reynolds, V. R.

WINSDOR

Combustion Engr. Inc. Miller, Carl E.

DELAWARE

CLAYMONT

Other Clayton, Robert L.

NEWARK

Other \*Krejci, Milo W.

WILMINGTON

Atlas Powder Co.
Colson, Max E.
Dedman, James E., Jr.
Gottshall, Ralph K.
\*Jeffries, John M.
McCarron, John F.
McFarland, David M.
Reinhart, Walter L.
Rennhack, Gilbert A.
Romig, John L.
Sanders, Marshall T.
\*Thomas, Andrew H.
Ziminsky, George L.
E. I. du Pont de Nemours & Co.

Anomas, Andrew H.
Ziminsky, George L.
E. I. du Pont de Nemours & Co.
Berry, Charles E.
Brown, Tom T.
Croze, Waiter W. J., Jr.
Dana, Edmund L.
Evans, Clarence H.
Fulton, Robert B., III
Grogan, Robert M.
Maldeis, Frederick W.
Oppermann, Albert B.
Pomeroy, Chester M.
Schaaf, Herbert L.
Temple, Alan K.
Watson, Fred J.
Wieland, Carson E.
Wise, Leonard G.
Fenix & Scisson, Inc.
Geary, Daniel
Hercules Powder Co.
Bishop, William T.
Brown, Thomas E.
Budd, Montgomery R.
Crabtree, Robert Wilson
Dowling, Jerry C.
Forster, Albert E.
Hammond, Philip R.
Hayes, Jack D.
Hintz, Edwin A.
Hurley, Lawrence F.
Kelleher, J. Joseph
Lawrence, Robert W.
Martin, John M.
Ryan, John R.
Schin-Er, J. H., Jr.
Short, Thomas D.
The Pyrites Co. Inc.
Wilson, Alex G.
Other
Ballard, C. W.
Lociter J. Lociter V.

Wilson, Alex G.
Other
Ballard, C. W.
Clark, Lucius V.
Hoskins, Ben B.
Nice, Milo A., Jr.
Seibert, Kenneth T.

DISTRICT OF COLUMBIA

Aero Service Corp.
Whitaker, John C.
Allis-Chalmers Mfg. Co.
Tally, O. V.
Am. Mining Congress
Conover, Julian D.
Sail, George W.
Van Evera, Robert W.
Arthur D. Little, Inc.
"McGann, Paul W.
Bituminous Coal Operators
Assn.

Assn. \*Fox, Edward G. Trevorrow, George C. oni, Watkins, Jason & Co.,

Boni, Watkins, Jason & Co., Inc.

"Netschert, Bruce C. Export-Import Bank of Washington DeCelles, Arthur E. Rutledge, Franklin A. Federal Coal Mine Safety Board of Review Price, Edwin R. Iron Ore Lessors Assn. Inc. Filnn, William C. Linderman Engr. Co.

"Roosevelt, Cornelius Van Schaak Mechanization Inc.

Van Schaak
Mechanization Inc.
Coombes, Russ
\*Fleming, Robert M.
\*McCurdy, Wayne A.
Mining Congress Journal
Jackson, Glenn F.
Pinkard, David W.
National Coal Assn.
Hardy, Carroll F.
Helt, Wilbur C.
\*Sullivan, G. Don \*Sullivan, G. Don National Coal Policy Confer-

\*Moody, Joseph E.

\*Parker, Glen L.
Nat'l Crushed Stone Assn.
Gray, Joseph E.
Nat'l Sand & Gravel Assn.
Walker, Stanton
Nat'l Slag Assn.
Bauman, Edward W.
Resources Research Inc.

\*Bennett, Evan

\*McCabe, Louis C.
Royer and Roger, Inc.

\*Gakner, Alexander
So. Cal Producers Assn.

\*Benson, James B.
Davis, C. William
So. Railway System
Shufflebarger, Thomas E..
Jr.
United Mine Workers of
America

\*Perguson, Charles R.

America
\*Ferguson, Charles R.
Kennedy, Joseph T.
U.S. Atomic Energy Commis-

Faulkner, Rafford H. Gabelman, John W. Hamburger, Richard Johnson, Jesse C. Kennedy, Richard H.

Kennedy, Richard H.
Lennemann, Wm. L.
Nininger, Robert D.
Storm, Howard
S. Bureau of Mines
Allsman, Paul T.
Ankeny, Marling J.
Baroch, Charles T.
Boyd, William T.
Caliaway, Harry M.
Cole, John W.
Crentz, William L.
DeHuff, Gilbert L., Jr.
Denton, Thomas C.
Dierks, Henry A.
Dupuy, Leon W.
Ellertsen, Donald E.
Frendzel, Donald J.
Gottley, Sidney

gottley, Sidney
Govinn, G. Richards
Hamer, Paul O.
Kaufman, Alvin
Kimbell, Charles L.
Kuster, William V.
Lewis, Walter E.
MacMillan, Robert T.
Merrill, Charles W.
Miller, Thomas H.
Nelson, Arthur Paul
Noe, Frank E.
Pehrson, Elmer W.
Perry, Harry
Reno, Horace T.
Rice, William E.
Schreck, Albert E.
Schler, Barry F.
Wells, Rollen H.
Birving, Donald R.
Johnson, R. F.
Juhre, Charles C.
Kinkel, Arthur R., Jr.
Kirkemo, Harold Klepper, Montis R.
Lang, Walter T. B.
Larrabee, David M.
LeGrand, Harry E.
MacKallor, Jules A.
Miller, Ralph L.
Newman, William L.
Nolan, Thomas B.
Norton, James J.
Rogers, Cleaves L.
Schaller, W. T.
Simpson, Thomas A.
Stuart, Willbur T.
Turner, Joe D.
Waesche, Hugh H.
Withington, Charles F.
Wrather, William Embry
S. Government

U.S. Government Abrams, B. B. Adelstein, Benj Allen, C. W.

Connecticut-Florida

Arundale, Joseph C. Barlow, Wallace D. Barlow, Wallace D.
Bible, Alan H.
Brandenburger, Oscar L.
Brichant, Andre L.
Caldwell, David L.
Ching, Michael
Croston, John
Ferriter, Robert L.
Fredell, Clarence A.
Fruitman, Frank W.
Grant, Robert Y.
Harris, Charles V.
Hart, Franklin A.
Herzog, Emanuel
Hill, John F.
Hilton, Gene T.
Hyde, Pitt W.
Johnson, Frank E.
Lamb, George A.
Larson, Leonard P.
Lasky, Samuel G.
Maday, Donald S.
Martin, Williams Swift
McCormick, Robert B.
McGinnis, Russell C.
McMahon, Albert D.
McPherson, James D.
Moore, Perry N.
Moulds, Donald E.
Murphy, Fred M.
Oliver, John G.
O'Neill, Leo J.
Perkins, Russel C.
Piein, Leo N.
Repass, Merle M.
Richardson, G. R.
Rube, Karl
Selfridge, George C.
Shafer, William L.
Shaver, Ralph N., II
Shives, Thomas R.
Simmons, Philip W.
Smith, Richard W.
Steidde, Edward
Ward, James B.
Whita, Raymond E.
Wilson, Clark L.
Wilson

Wright, Charles Willher
Barr, James A., Jr.
Bradbury, Wm.
Carpenter, M. H.
Chapman, Edward P.
Ferguson, Henry G.
Fieldner, Arno C.
Fraser, Thomas
Gealy, Edgar J.
Holt, Stephen P. H.
Hosted, Joseph O.
Johnson, Charles H.
Jones, Frank A.
Leonard, Morton F.
Lockwood, Benoni, Jr.
Lytzen, W. W.
Martin, Thomas E.
Mattila, Arne A.
Miller, Robert B.
Minister, Percy F.
Morris, Henry C.
Swill, David C.
Smith, Henry C.
Smith, H. A.
Smith, Herbert W.
Smith, Howard I.
Webb, Wm. Y.

FLORIDA

AUBURNDALE Emery Industries, Inc. Ruston, Norman A.

BARTOW

Amer. Cyanamid Co. Haynsworth, E. M. Armour Agricultural Chem.

Armour Agricultural Che
Co.
Hedrick, Harold N.
W. R. Grace & Co.
Allen, Willie A.
Clary, Joe D.
Elliott, Fernley H.
Fort, W. R.
Frost, Alexander J.
Jones, Benjamin P.
Olsen, Clarence G.
Wiggins, V. I., Sr.
Int. Min. & Chem. Corp.
Barnett, John C.
Campbell, Colin A.

# Florida-Hawaii

Cole, Allen T.
Cook, Charles C.
Cox, James L.
Crosk, William C.
Ellis, Edward J.
Felgin, Harry M.
Fenske, Douglas H.
Frye, James L.
Garcia, Raymond G.
Giles, Claud B.
Guy, Richard D.
Haarmann, H. A.
Hahn, Allan J. P.
\*Loper, F. Gail
McClintock, Waiter O.
Smith, Matthew T.
Sprott, Wm. T.
F. M. Murphy & Assoc.
Houston, Wesley M.
Polk Equipment Co. Inc.
Becker, John N.
Booream, John W.
Swift & Co.
Hunter, Charles E.
\*White, Frank E.
Self Employed
Pamplin, John W.
Other
Abbitt, James M.
Bowen, Floyd B.
Casler, E. T.
Cooper, Howard F.
Guffey, A. A.
Hall, Jeptha R.
Lynch, Dan H.
Mayberry, Richard C.
McArthur, Milton P.
McLaulin, Doug P.
McMullen, Donald
Pierce, E. A.
BOCA RATON Cole, Allen T.

# BOCA RATON

Other \*Morty, Edgar O.

## BRADENTON

Brown, W. T. Connor, Charles W. Nold, Harry E.

# BREWSTER

Am. Cyanamid Co. m. Cyanamid Co. Chesson, Maywood W. \*Childs, William B. Crago, Arthur \*Custred, U. K. Lyle, George L. \*Patterson, Thomas J. Taber, Robert L. \*Watkins, S. Clyde \*Weaver, J. L. Brice, Charles D. Lassiter, M. S.

# CLEARWATER

Self Employed \*Woody, Guy V. Other Clark, Robert J. Johnson, H. B. Moore, William A.

# COCOA BEACH

Other Jacques, Neal M.

# CORAL GABLES

Other Ahbe, Frederic R. Frank, V. E.

# CRESCENT CITY

Self Employed \*St. Clair, Stuart Other Denton, Fred W. Jr. Largent, Neely C.

# DELAND

Other Hunner, Guy B.

# EAU GALLIE

Duffey, John I.

# FERNANDINA BEACH

Other Roberts, Edw. N

# FT. LAUDERDALE

Latite Roofing & Mfg. Co. Inc. Engskow, John B. Other

Lednum, E. T. Lentz, Gene

#### FT. MEADE

Other Green, James L.

# FT. PIERCE

Self Employed \*Vogel, Herman H.

# GAINESVILLE

Univ. of Florida
\*Gaynor, Thomas E. Other Davis, George E., Jr.

# GOLDEN BEACH

Other Kurvla, Michael H.

#### HIAL EAH

Self Employed \*Hall, Robert B.

# HOBE SOUND

Other McConnell, Robt. E.

# HOLLYWOOD

Mack Industries, Inc. \*Miller, Fred A.

# JACKSONVILLE

JACKSONVILLE

Atlantic Coast Line R.R.
Councill, Richard J.
LeGrand, J. Ross
Carpco Res. & Engrg. Co.
\*Carpenter, James Hall
\*Dyrenforth, Wm. P.
\*Huang, William Minsheng
Stewart, Edwin H., Jr.
Humphreys Min. Co.
\*Beebe, Edward S.
Siprelle, W. J.
\*Whittle, Eugene V.
Wood, Jay P.
Self Employed
\*Barthelemy, Roger E.
\*Dyrenforth, Don
Other

# Other Strange, Charles H. Zaskalicky, M. F. KEYSTONE HEIGHTS

Other Sutton, Harold L.

# LAKELAND

American Cyanamid Co.
Finger, Diamon L.
Industrial Services
\*Barbarowicz, William
New Concept Co.
\*Cannon, Harry B.
Gerst, Hugh A.
Wellman-Lord Engrg. Inc.
\*Sikora, Eugene S.
Seif Employed
\*Creasy, M. Richard
Other Abercrombie, Harry W. Bolton, William R. Bolton, William R.
Chapman, Chas
De Stefano, M. C.
Hopkins, Robert H.
Lawver, James E.
Martinasek, M. V.
Murphy, A. H., Jr.
Purcell, E. J.
Richter, Roscoe
Saunders, Robert N.
Uhland, H. E.
Vogler, Frederick A.
Wallom, D. E.
Wunsch, Phil G.

Other Faulds, N. Morris

# LIVE OAK

Live Oak Stone Co.
\*Blake, Daniel

# MELBOURNE

Boeing Airplane Co. ATS Strong, Ronald D.

Basic Metals & Coal Corp. Martin, George W.

Oolite Crushed Stone Co. Harrington, Leroy J. Univ. of Miami Marine Lab. \*Luft, Stanley J. Selt Employed \*Wolcott, Frank B.

\*Wolcott, Frank B.
Other
Colitz, Michael J.
Hoover, Ray P.
Robinson, Howard S.
Zehel, Robert J.
Ziebell, Walter R.

#### MILTON

Other Deptula, W. J., Jr.

# MULBERRY

Fla. Conveyor & Equip. Co.
Kain, Arthur F.
R. H. Clark Equip. Co.
Heathman, Elvin S.
Jensen, T. J.
Int. Min. & Chem. Corp.
Haseman, Joseph F.
Kauffman, Robert D.
Watt. Stuart G.
Oak Ridge Saw Co.
Bergquist, Richard B.
Other

Barnett, Grady Carter, W. F. Hewett, L. F. Quina, Herbert R. Selvidge, R. C.

# NICHOLS

-Carolina Chem. Corp. Barnett, Dave H. Brooke, Tommy D. Dean, Arnold W. Hughes, Charles V. O. Toler, Vivian D. Oth her Pascoe, Hubert L

### ORLANDO

Brown, David L. U.S. Other Smith, Richard A.

# PANAMA CITY

Other Nelson, O. J.

# PENSACOLA

Self Employed
\*Holland, Arthur A. Other \*Gray, Latham B.

# PIERCE

Armour Agri. Chem. Co. Bergquist, Francis R. \*Breathitt, Harvie W., Jr. Gruel, John S., Jr. \*Hatch, John F.

# PLANT CITY

Smith-Douglass Co. Inc. Hollingsworth, Clinton A. Mills, Clyatt, E. Morrow, Donald R. Wester, Jordan L., Jr. Wayne Thomas, Inc. \*Thomas, Wayne Other. Oth Martinez, Federico McLaughlin, S. E.

# POMPANO BEACH

Self Employed Wandke, Alfred D.

# PORT RICHEY

Port Richey Mining Corp.
\*Edwards, Charles G. Other Jones, Jack O.

# RUSKIN

Other Goodwin, Robert C.

# ST. AUGUSTINE

Other Little, Archibald Ponton, Gerald M.

# ST. PETERSBURG

Self Employed

\*Ankudinoff, Nicholas G.
Clarke, W. J.
Dean, Elbridge Gerry

Otis, LeRoy M.

Roehm, John Christian
Trotter, Arthur H.

Uhle, David J.
Uhle, T. T.
Wiggins, Ralph R.

# SARASOTA

Other Remick, Walter L. Sunday, William E.

#### STARKE

I. du Pont de Nemours & Co. Ruffini, John A.

Self Employed \*Morgan, John Davis, Jr.

#### TALLAHASSEE

Coastal Petroleum Co.
\*Bates, John
Florida State Univ.
\*Buie, Bennett Frank
Florida Geol. Survey
Vernon, Robert O.
Other Other Paine, William R.

## TAMPA

Cameron & Barkley Co.
Taylor, Don L.
S. A. Canariis Corp.
"Canariis, Svend A.
Hewitt-Robins Inc.
Wallace, John A.
Pat Flanagan, Inc.
Horton, Arthur L.
Port Sutton, Inc.
"Thomas, Robert
U. S. Phosphoric Products
Lowzow, Odd
Self Employed
Fiedler, Harry L.
Other Other Mead, Harry Levi

# TITUSVILLE

Electro-Mech. Systems, Inc. \*Hare, H. J.

# VERO BEACH

Other Metz, Gilbert F.

# WARRINGTON

Isern, Elmer H.

# W. HOLLYWOOD

Other Petrowsky, W. J. Young, Kenneth E.

# WINTER HAVEN

Ridge Hartstone, Inc. Fox, Harold F. Other
Poll, Jay A.
White, Sherman A.

Apex Minerals Corp. Gray, William B., Jr. Other
Deal, Troy M.
O'Neil, Frederick W.

# GEORGIA

# ANDERSONVILLE

American Cyanamid
\*Langdon, Charles F.

# ATLANTA

Armour Agri. Chem. Co.
Carey, Thomas L.
Atlas Copco, Inc.
"Jennings, Robert D.
Georgia Dept. Mines & Geol.
"Fortsom, Charles W., Jr.
Peyton, Garland
Georgia Inst. of Tech.
"Mitchell, Lane
"Husted, John E.
St. Hgwy. Dept. of Ga.
Wegel, Frank J.
Upson County Mica Co.
Cronheim, Samuel P.
Vulcan Material Co.
"Hinkle, Wm. E.

Other ner Bauer, Hans A. Hume, J. N. Johnston, L. J. W. Ullmer, Robert J.

# ATTAPULGUS

Minerals & Chemicals Philipp Pedler, Albert H.

## AUGUSTA

Ga. Iron Works Co.
Hardy, Harvey B.
Georgia-Pacific Corp.
Ritter, William M.
Zimmerman Evans & Leopold
Daniel Field
\*Langa, Stephen P.
Other Other Wills, Wm. A

#### CARTERSVILLE

Thompson, Weinman & Co. Beavers, G. W.

# CHATSWORTH

Southern Talc Co.
\*Glenn, M. Woodard

# COLUMBUS

Hardaway Contr. Co. Venable, Geo. M., Jr.

# DONALSONVILLE

Other Kminek, John M.

# DRY BRANCH

. Kaolin Co. Fargason, David J.

## ELBERTON

Aston Mineral Engrg. Service \*Lee-Aston, R. Other Coggins, Burton F.

# FT. BENNING

U.S. Army Chamberlin, Paul D.

# GORDON

Southern Clays Inc. Scott, John W. M. Other Auvil, Jesse H., Jr.

# HUBER

J. M. Huber Corp. Oxford, Edward F. Rogers, Jack A. Whitehead, Don A.

# LITHONIA

Georgia Marble Co. Severinghaus, Nelson

# MACON

Burns Brick Co.
\*Burns, Henry K., Jr.

# MARIETTA

Other Willingham, Chas B. McINTYRE

# Min. & Chem. Corp. of Amer. Todd, A. C., Jr.

SANDERSVILLE United Clay Mines Corp. Carlson, Roger M.

# TATE

Georgia Marbie Co. Severinghaus, Nelson, Jr. Smith, W. L. Other Rockwell, F. E., Jr. Zibell, J. Scott

# THOMASVILLE

Dawes Silica Min. Co. Pierson, Richard E.

# HAWAII

# HONOLULU

Highway Construction Co.
\*Ching, Larry F. C.

University of Hawaii \*Cox, Doak C. Other Palmer, Harry B.

PUUNENE MAUI TERRI-TORY

Other Simpson, Julian E.

# IDAHO

# ALAMEDA

Other Henriksen, A. J.

BANKS

Anderson Minerals Co. \*Anderson, H. Ferrel

# BAYVIEW

Federal Resources Corp. Campbell, Walter N. Other Condie, Bruce

#### BOISE

BOISE

Barton, Stoddard & Milhollin

\*Barton, Sherwin M.

Butler Engr. Assoc.

\*Butler. Thomas C., Jr.

Hermada Mining Co.

\*Oberbillig. Ernest
Idaho Mining Assoc.

Marsh, Harry W.

Teske, Aiden J.

Intermountain Equip. Co.

Dufford, Philip A.

Porter Bros. Corp.

\*Porter, Richard B.

Selby Drilling Corp.

Selby, Robley E.

Talache Mines, Inc.

Burroughs, A. H.

Whalen & Co.

\*Whalen, Jerry F.

Other.

Fletcher, George D.

Other
Fletcher, George D.
McFarlane, J. C.
\*Moore, David L.
Stoddard, Bruce W.
\*Wagner, Warren R.

# BONNERS FERRY

Other Goodrich, James P.

# BOVILL

J. R. Simplot Co. Lothrop, Robert A. Prater, Lewis S.

# CHALLIS

Umont Mining, Inc. Wheeler, Dooley P., Jr.

# COEUR D'ALENE

Garber, C. Y. McDougall, S. W

# CONDA

J. R. Simplot Co. \*Smith, Donald C

# GOLDEN

Center Star Min. Lynch, Harold C.

# HAYDEN LAKE

Other Hundhausen, R. J.

# IDAHO FALLS

General Electric Mann, Robert C.
Phillips Petro. Co.
\*Godfrey, Garvin H.
Shaffer, James F.

# KELLOGG

Bunker Hill Co.

\*Baker, Douglas
Bethune, A. Y.
Bracken, E. O.
Drewry, Don W.
Griffith, LeVern M.
Hammerand, Veral F.
\*Horsman, Raymond J.
Kirkpatrick, Kenneth K.
McConnel, Roger H.
\*Mize, Robert J.
Muhs, Robert A.

\*Olps, E. B. (Ted)
Park, M. Austin
Prindle, Fred L.
Sather, Norman J.
Tapper, Thomas M.
Frank N. Marr Lesse
\*Redding, Curtis F.
Sidney Min. Co.
Brown, Malcolm C.
Sunshine Min. Co.
\*Colson, James B.
Copeland, James B.
Durham, James C.
Johnson, H. Bradley
\*Sharp, Franklin H.
Other

Other her Gordon, Joseph E. Hathhorn, Charles C. Mahoney, Benj. F. McKinnis, William B. Nugent, Alfred E. Riley, Robert E.

#### McCALL

Self Employed Evans, Mark

## MEDIMONT

Self Employed Walker, Pierce C.

# MONTPELIER

Central Farmers Fertilizer Co. \*Hand, David
San Francisco Chemical Co.
Barcus, Robert K. Other Sacrison, C. R.

#### MOSCOW

Univ. of Idaho

"Cook, Earl F.
Newton, Joseph
"Staley, William W.
"Whiting, Jerry M. Other
Crosby, James W., III
Fahrenwald, A. W.
\*Williams, Robert S.

#### MOUNTAIN HOME

S. Air Force
\*Grosskreutz, Henry H.
\*Rausch, Paul E. Other Mashburn, L. F.

# MULLAN

Other Haeseler, A. E.

# NAMPA

Dewey, William C.

# OSBURN

Anderson, Wm., Jr. Simos, John G.

# POCATELLO

FOCATELLO
Food Mach. & Chem. Corp.
Edwards, Robert L.
Fowler, Heath B.
\*Hayden, Russell J.
\*Heim, George W.
Prebble, Bert
Howard, Richard I.
Larsen, Veryl E.
Lowry, John W.
Martin, George Wm.
Power, O. A.
Rooney, Fred S.
Vincent, Kenneth C.
Young, W. Arthur
J. R. Simplot Co.
Garrand, Leonard J.
Kilbourne, W. Grant
Peterson, Phillip T.
Other

Peterson,
Other
Clouser, John F.
Hill, Robert B.
Pothier, O. Edw.
Scardino, James J.
Willey, Stephen F.

# PRIEST RIVER

Self Employed \*Neyman, R. W

# SALMON

Oref, Wallace R.

## SILVERTON

Other Visnes, N.

# SODA SPRINGS

Monsanto Chem. Co. Atwood, George L. Crouse, Russell H.

#### TROY

A. P. Green Fire Brick Co. of Idaho Buchan, Michael A.

# WALLACE

WALLACE

Amer. Smeit. & Refin. Co.
Deshler, Geo. A. F.
Gordon, Robert G.
Kesten, S. Norman
Kieffer, J. C.
Meicher, Milton A.
Russell, Robert L.
Clayton Silver Mines
"Smith, Norman M.
Day Mines, Inc.
Day, Henry L.
"Farmin, Rollin
"Sparks, Carville E.
Hecla Ming. Co.
Bell, J. Douglas
"Craig, John G.
Crandall, Wallace E.
Davis, Robert B.
"Droste, Keith J.
Edwin, Charles H.
Love, William H.
Randall, Lester J.
Sorensen, Arthur H.
"Sorenson, Robert E.
Lucky Friday Silver Lead
Mines, Co.
"Folwell, William T.
Mountain Goat Lease
Rice, Robert A.
Silver Buckle Mining Co.
Cloward, George L.
Other
Austin, Robert B.

Cloward, George L.
Other
Austin, Robert B.
Berg, J. Edward
Crosby, Garth M.
Featherstone, Wray
Kimes, Dale K.
Kirkeberg, Knute, Jr.
Portaro, Edgardo
Rice, Gary R.
Shook, Herbert H.
Wilhelm, George L.

# YELLOW PINE

Other Abstein, Henry T.

# ILLINOIS

# ALEDO

Self Employed Edwards, John I.

# ALTON

Self Employed Kehr, Edwin A. Other Crum, E. H.

# AURORA

Barber Green Co.
Evans, Charles E.
Stephens-Adamson Mfg. Co.
Parkin, Donald W.
Thor Power Tool Co.
Johns, B. H.
McNabb, Donald G.

# BARRINGTON

The Quaker Oats Co. Boss, Charles G. Wright and Co. Willett, James R.

# BELLEVILLE

Waste Disposal Serv. Inc. \*Markwardt, Earl W. Other Breidenbach, G. C.

# BENTON

Old Ben Coal Corp. Baseley, Dean W. MacDonald, J. W. Other Hodgson, C. H.

# CAIRO

Other Sullivan, Dan A., Jr.

## CANTON

Other Gaber, Andrew J. \*Schickedanz, Louis H.

#### CARBONDALE

Southern Illinois Univ.

\*Amos, Dewey H.

# CAVE-IN-ROCK

Minerva Oil Co. Rule, William T. Other Musson, George H.

## CHICAGO

Allen & Garcia Co.

\*Cuthbert, William R.
\*Dowlin, Donald H.
\*Fitzgerald, P. H.
\*Garcia, John A.
\*Von Meding, Wm. A.
Allis-Chalmers Mfg. Co.
Schaub, Henry W.
Amer. Brake Shoe Co.
Morel, George H.
Perry, Thomas A.
Ward, Gilfry
Amer. Mang. Steel Div.
Nickel, Henry W., Jr.
Armour Industrial Chemical
Co.

Nickel, Henry W., Jr.
Armour Industrial Chemics
Contents, Hoyt M.
The A. T. & S. F. Ry. Co.
Evans, T. O.
Evans, T. O.
Evans, T. O.
Connell, G. B., Jr.
Beil & Zoller Coal Co.
Rasmussen, Roswell C.
A. J. Boynton & Co.
Boynton, Arthur J.
Eberlein, John B.
Bucyrus Erie Co.
Vines, Henry J.
Calumet & Hecla Inc.
Lovell, Endicott R.
Petermann, A. E., Jr.
Cardox Corp.
Manley, Paul C.
Climax Molybdenum Co.
Goth, John W.
Commercial Test & Engr.
\*Langtry, Wilmer D.
Continental Materials Corp.
\*Gunther, Sidney M.
Dorr-Oliver Inc.
\*Johnson, Roy A.
Dunn Coal & Oil Co.
Edwards, Philip J.
E. I. du Pont de Nemours &
Co.
Jones, Albert A.

Dunn Coal & Oil Co.
Edwards, Philip J.
E. I. du Pont de Nemours & Co.
Jones, Albert A.
Engineering & Mining Journal Chase, Charles H.
Freeman Coal Mining Corp.
'Isenberg, Nathan Mauck, H. Eugene Redfearn, Donald F.
Gen. Amer. Trans. Corp.
'Gutzeit, Gregoire
'Lyons, Emerson J.
Seery, Frank E.
Goodman Mig. Co.
Ahlen, Louis S.
Caine, Kenneth E.
Cunnigham, Morris, F.
'Ferguson, William T.
Goodman, Howard
Goodman, William E.
'Long, Norman W.
Newton, John S.
Great Lakes Carbon Corp.
'Triska, Alfred A.
Hammermills, Inc.
Schatz, Warner S.
Hardinge Co., Inc.
Power, Jack D.
Hooper-Green Co.
Green, J. G.
Ingersoil-Rand Co.
Olund, Robert L.
Inland Steel Co.
Block, Philip D., Jr.
Graff, Howard M.
Hunter, Lemuel B.
Johnson, Halmar W.
Johnson, Robert E.
Pace, E. Minor
International Harvester Co.
Bercher, Harry O.
Lindgren, Roy A.
Jet Oil Co.
Green, Thomas Howard
Victor H. Jones
'Adama, Robert A.
Joy Mig. Co.
Scherr, Eugene F.
Spotte, Walter V.
Kalser Engineers
Hyatt, Wesley
'Milliken, Clinton L.
Link-Belt Co.
Davidson, D. E.

Gerler, Warren C. Linton, Thomas Millard, Laurance O.

Millard, Laurance O.
Long-Airdox Company
Hennessey, Wm. R.
Noel, William E.
MacLean-Hunter Publ. Co.
\*Meschter, Elwood, Jr.
Marquette Cement Mig. Co.
Hanks, Howard, Jr.
Hedley, Paul M.
Materials Service Div.
\*Dirkes, George E.
\*Schoenberger, Pope
John F. Melasner Engrs. Inc.
\*Larson, Bennett C.
\*Melasner, John F.
Williams, Nolan H.
Mid Continent Coal & Coke
Co.

"Meissner, John F.
"Williams, Nolan H.
Mid Continent Coal & Coke
Co.
Wood, Leighton S.
Mining World
Sargent, Fred R.
Morton Salt Corp.
Adams, Robert Leroy
Campbell, William C.
Pacific Mining Ind.
Ritach, Howard P.
Far Associaties
Trauffer, Walter E.
Froductive Equipment Corp.
"Lehman, Lewis H.
Roberts & Schaefer Co.
"Chen, Wen L.
"Dawson, Raymond E.
Ford, James H., Jr.
Griggs, Elbert C.
Ludwigsen, Orville I.
McCulloch, William C.
Reeves, Phil C.
Taylor, William S.
"Wender, James D., Jr.
Rock Froducts
Lenhart, Walter B.
"Rockwood, Nathan C.
Sahara Coal Co.
"Hayden, Carl T.
Herder, Howard A.
Woods, Henry C.
J. Schonthal & Assoc., Inc.
Schonthal, Joseph
Shasta Coal Co.
"Stevens, E. F.
Standard Silica Corp.
Allport, Hamilton
Traylor Engineering & Mfg.
Co.
"Weddle, J.
L.
Truax-Traer Coal Co.

Allport, Hamilton
Traylor Engineering & 1
Co.

\*Weddle, J. L.
Truax-Traer Conl Co.
Dodds, Robert A.
Livingston, Harry C.
Shumate, Mack H.
Tibbs, Harry M.
M. H. Treadwell Co., Inc.
\*Sayre, Paul L.
United Electric Coal Co.
Emling, Dale H.
Huey, John J.
Inman, Robert H.
Kolbe, Frank F.
Utterback, G. H.
Univ. of Illinois
Karpinski, R. W.
U. S. Gypaum Co.
Appleyard, Frank C.
Dorian, James C.
Eckrote, K. R.
U. S. Rubber Co.
Knobloch, Richard F.
Wedron Silica Co.
Gawthrop, Afred
Paul Weir Co., Inc.
\*Ball, Clayton G.
Gammeter, Erwin
\*Good, John E.
Jones, Wilmot C., Jr.
\*Kachik, David J.
Price, Harold Lewis
Ross, Stewart H.
Weir, Paul
\*Zimmerman, Raymond
Western Electric Co.

"Weir, Paul
"Zimmerman, Raymond E.
"Zimmerman, Raymond E.
Western Electric Co.
Scott, J. Waiter
Western Knapp Engrg. Co.
Engle, Lester F.
"Martschinke, William C.
Young, Robert K.
Wisconsin Steel Works
Wheatley, R. P.
Zeigler Coal & Coke Co.
Benowicz, Casmer A.
Zonolite Co.

Benowicz, Casmer A Zonolite Co. Kelley, Joseph A. Self Employed \*Lofquist, Ralph J. \*Patterson, Raymond

Other
Anthonisen, Robt. P.
Bassett, Horace Y.
Briggs, H. Kenneth
\*Bryant, Albert D.
Cain, Hollis B.
\*Chapman, George H.

# Illinois-Indiana

Crown, Irving
Destry, Donald M. J.
Eberle, Herman R.
Fiterman, Morlan E.
Hammer, Edward J.
Hernandez, Clinton N.
\*Holmes, Albert W.
Kremm, G. F.
Mataich, Peter F.
Parks, John
Slomer, Joseph J. Parks, John Slomer, Joseph J. Tobey, Julian E., Jr. Treadwell, Harry A.

# CHRISTOPHER

Other Moroni, Eugene T.

#### CICERO

Ind. Filter & Pump Mfg. Co. \*Zievers, James F.

#### CLARENDON HILLS

Snarr, James W.

# COAL CITY

Other McKee, M. A.

# COLLINSVILLE

Other Brown, Oren P.

# DANVILLE

Self Employed
\*Butcher, Fred E.

# DECATUR

Fritz, John L. Hays, William B.

# DEERFIELD

Othe Hearn, Jane K. Signer, M. I., Jr.

# DES PLAINES

Self Employed \*Brown, Levi S. Other Solbrig, Charles V.

Ill. State Highway Dept. Kustka, Joseph R.

# DOWNERS GROVE

John L. DuMond Co DuMond, John L. Other Dahl, Doring C.

# DUNDEE

Other Kromer, A. S.

# DU QUOIN

Truax-Traer Coal Co. Dress, John L. Other Albon, Dean E. Harrell, Milford V.

# EAST ALTON

Olin Mathieson Chem. Corp. Hamilton, Norl A. Wetzel, James L.

# EAST ST. LOUIS

Aluminum Co. of Amer.

Bell, Gordon M.

American Zinc & Smelting Other Co.
Burgess, J. Wesley
C. K. Williams & Co.
Stewart, T. J.

# ELDORADO

Minerva Oil Co. Montgomery, Gill

# FLGIN

Other Manderfield, Chas. Y.

# ELIZABETHTOWN

Minerva Oil Co. \*Saxby, Donald B Other Anderson, O. E.

#### ELSAH

Principia College \*Gore, Dorothy J.

# EUREKA

Other Reesman, Richard H.

# EVANSTON

Dickson Weatherproof Mail Co. \*Dickson, Robert B. Northwestern Univ.
\*Dapples, Edward C.

# EVERGREEN

Other Anderson, Charles S.

### FIATT

Truax-Traer Coal Co. Luxner, James V.

# FLOSSMOOR

Other Gillies, F. M.

# FOX RIVER GROVE

Mining Engineering Wilson, R. W.

# GALENA

The Eagle-Picher Co.
Arndt, William E.
Denny, Richard L.
Haffner, Robert L.
Haman, Harold H.
Wharton, Foster B.
Ziesing, Gordon F.
Willowa Engrg. Co.
Miles, Edwin H.

# GALESBURG

Antipol Corp.
\*Richards, Lee O.
Bixby-Zimmer Engr. Co.
Rose, Colin G.

# GLENCOE

Other Young, Wm. P.

# GLENVIEW

Other Nordberg, Bror

# GRANITE CITY

Granite City Steel Co. Ordway, Francis L.

# GREENVILLE

Coates Steel Prod. Co. Lowe, Robert C.

# HANOVER

Other Kuehneman, Robt. J.

# HARRISBURG

Sahara Coal Co. Bottomley, J. A.

Prairie Steel Co. Bixby, Kenneth R.

HIGHLAND PARK Amer. Brake Shoe Co. Baker, Thomas C., Jr.

Blazovic, P., Jr. Miller, R. G., Jr.

# HILLSBORO

American Zinc Co. of Ill. Wampler, Harold R.

# HINSDALE

American Chrome Company \*Lukens, John L. Other Wagner, Raymond

# LA GRANGE

Herschelman, E. C.

# LAKE FOREST

Other Proehl, Norman P. LIBERTYVILLE

Other Norstrom, C. F., Jr.

# LOMBARD

Other Komarek, Karl R.

# McCOOK

Armour Industrial Chem. Co. Baarson, Robert E. Treweek, Harold B.

# MCHENRY

Nelson L. Davis Co. \*Davis, Nelson L.

# MELROSE PARK

Hewitt-Robins Inc. \*Larsen, Edward P. Phillips, Chelsea F

# MOLINE

Other Ellis, James Oscar

# MT. CARMEL

Dow Chemical Co. \*Luehring, George E. Self Employed \*Sharp, C. Sheldon

# MT. PROSPECT

Other Orsborn, James T.

# NASHVILLE

National Mine Service Co. Conway, Clifford C.

# NORTH BROOK

Bilharz Mining Co \*Bilharz, Oscar Other Weir, John P.

# NORTH CHICAGO

Fansteel Metallurgical Corp. Highriter, Harry W.

# OTTAWA

Ottawa Silica Co.
Gerding, Paul A.
Gyger, Wayne B.
McClevey, Robert A.
Southcott, James F., Jr.
Stauber, Robert B.

Other her Burke, Barry L. Ellis, Joseph M. Matkovic, Mijo

# PALATINE

The Eimco Corp.

Dahlstrom, Donald A.

Dale, Lawrence A.

Risch, Robert A.

Vrablik, Edward R.

Oth Koulocheris, A. I. Silverblatt, C. E.

# PARK RIDGE

Wheelabrator Corp.
\*Culhane, Frank R. Other Glos, Edmond A., II 'Huedepohl, E. Bradley Lindsay, G. C.

# PAWNEE

Peabody Coal Co. Gilmartin, Denvir L.

# PEORIA

Caterpillar Tractor Co.

\*Haley, Wilbur A.

\*Hansen, Robert C.
McLeod, Gordon B.
Kress Engineering
\*Philippl, L. B.
Ill. Div. of Highways
Leong, Judson

\*Squires, Robert L.

Southwestern Ill. Coal Corp. \*Bridges, Raymond H.

# OHINCY

Gardner-Denver Co. rdner-Denver Co.
Boynton, Donald R.
Fishback, Niel M.
Gardner, John W.
Howard, John R.
Jeter, Frazer L.
Kuykendall, James E.
Mastrovich, John J.
Vaughan, Everett E.
her

# Other Ganz, R. H.

RIVER FOREST

# er Edgerton, B. P.

RIVERSIDE Other Listak, John

ROBINSON

# Self Employed \*Zwermann. Carl H.

ROCK ISLAND Bituminous Casualty Corp.

\*Herbert Charles F.

# ROSICLARE

Aluminum Co. of America
Bousman, Samuel G.

\*Harrison, William H., Jr.
\*Skeels, Waiter S.
Minerva Oil Co.
\*Daly, J. J.
Porter, Joseph A.
Ozark Mahoning Co.
Baille, Harold E.
Brecke, Ervin A.
Rosiclare Lead & Fluorspar
Blecheisen, Jacob
Other

Other

Spees, Durward C.

# SKOKIE

& Chem.

SKOKIE

American Colloid Co.
Bechtner, Paul
Johnson, John D.
\*Klingler, Boyd
Intnati. Minerals & Cl
Corp.
Beeman, Fred A.
Clawson, Floyd J.
Davidson, Robert N.
Dunbeck, Norman J.
Everhart, Donald L.
Fulghum, Weldon F.
Hunter, Frank Rogers
LeBaron, I. Milton
Loehr, H. Turner, Jr.
Menze, Richard J.
Fickard, Frank C.
Roe, Lawrence A.
Ware, Louis
Ware, Thomas M.
White, Nelson C.
Portland Cement Assoc.
Bates, A. Allan
Clausen, C. F.
Gruenberg, Asher
Forter, Edward S.
Tonry, J. Richard

# SPARTA

Walter Bledsoe & Co. Land, George W.

# SPRINGFIELD

Fox, James M. Jess, John A. Spanski, R. F.

# TAYLORVILLE

Other Craggs, Joe

# URBANA

URBANA

II. State Geol. Survey
\*Bradbury, James C.
\*Cary, Gilbert H.
Frye, John C.
\*Harrison, John A.
Helfinstine, Roy J.
Jackman, Harold W.
Lamar, John E.
Risser, Hubert E.
\*Shaw, Chester W.
Simon, Jack A.
Univ. of Illinois
\*Chedsey, Wm. R.
\*Eaclie, George R.
White, Geo. W.
\*Wright, Fred D.
\*Wuerker, Rudolph G.

Wuerker, Rudolph G.

# WESTERN SPRINGS

Other Richards, C. Lester Seerley, John J.

# WEST FRANKFORT

Freeman Coal Mining Corp-Garwood, Thos. L. Jankousky, C. K. Reddy, Narayan N. Sanford, Charles E. Williamson, Harry, Jr.

#### WHEATON

Self Employed
\*Burrows, John P.

### WINNETKA

Barber, A. Harris Bell, John H. Irwin, David D.

# INDIANA

REDFORD Other Ingalls, R.

# BLOOMINGTON

Indiana Univ Patton, John B.
\*Lowell, Wayne R.
Mead, Judson
Wier, Charles E.

# BROOKLYN

Hydraulic Press Brick Co. Caine, Richard J.

# BRUCEVILLE

Enco Collieries Inc. Yancik, James R.

# COLUMBIA

Other Hull, Raymond E

# CRANE

U. S. Navy Johnson, Edwin H.

# EAST CHICAGO

General American Transp. General American Corp.

\*Metheny, Donald E.
White, Earle A.
Inland Steel Co.
Kyrlakides, S. K.
Mack, Larry H.
Matthews, Wm. H.
U. S. Gypsum Co.
Ransom, William S.
Sieh, Clayton J.

# ELBERFIELD

Ingle Coal Corp.

# FORT WAYNE

The Deister Concentrator Co. Bliss, Roderick T. Griffin, Donald N. Mancini, Peter V. Stone, S. A. Tiernon, Carlos H.

# GARY

J. J. Grady Co., Inc.

"Armstrong, John
Grady, John J.
U. S. Steel Corp.

"Lee, Edward J.
Scelonge, Delmar John
Wood, Kenneth E.
U.S. Steel—Universal Atlas
Cement Div.
Ludwig, Norman C.
Kowalyshyn, T. J.
Rader, Herbert L.
University Club
Cavanaugh, John P.
Other Other Lucke, Edward W.

# HAMMOND

Inland Steel Co. Rule, Albert R. Other Mareta, Joseph T.

# INDIANA HARBOR

Inland Steel Co. Moliken, William R. Sheets, Cleo B.

#### INDIANAPOLIS

Allison Div. of GMC

\*Caple, William G.

Ayrshire Collieries

\*Hightower Thomas R.

Merle, James J.

High Lime Rock Co., Inc.

King, Addison H., II

Link-Belt Research Lab.

Pearson, Donald A.

P. R. Mallory & Co.

Sigurdson, Harold

Morgan Coal Co.

Spears, Miller E.

Stonefort Corp.

Dukes, William W.

Sherwood, Samuel F.

Other

ther Hillery, Chas. M. Hitchcock, C. K. Reese, John P. \*Tuttle, Max A.

MEDARYVILLE

Other Rosenberg, Louis

MICHIGAN CITY

Joy Mfg. Co. Norrick, Robert F. Whinnen, W. J. R. I. Ry. \*Sibley, Milton W. Other Clemons, Robert E. Connelly, Thos. J.

MUNCIE

Indiana Steel & Wire Co., Inc. Holmes, Alvin W.

MUNSTER

Other Schwarz, Arthur M. Ziehl, Othon A.

NEWBURG

Alum. Co. of Amer.
\*Greves, John H.
\*Yeager, George G.

NOTRE DAME

Univ. of Notre Dame \*Peretti, E. A.

OAKLAND CITY

The Enos Coal Min. Co. Mullins, Richard A.

RENSSELAER

St. Joseph College \*Nieset, Carl F.

SHOALS

U. S. Gypsum Co. Steinmann, Walter D. Wynn, Leonard E.

SULLIVAN

Other Hannum, Arnold M.

TERRE HAUTE

Snow Hill Coal Co. Gossard, Amzi G. Templeton-Matthews Corp. \*Matthews, Max A. Other Lee, Hugh B. Stewart, Lafe

VINCENNES

Enoco Collieries Inc. Conrad, Heber A. Stachura, John A. Other Whittaker, R. W.

WABASH

U. S. Gypsum Co. House, Robert M.

WARSAW

Amer. Brattice Cloth Marshall, Lawrence K. Mikesell, D. Blaine

WEST LAFAYETTE

Purdue Univ.
\*Pullen, M. William

WOOD RIVER

Jeffries, George E.

IOWA

AMES

Iowa State Univ.

\*Gwynne, Charles S.

\*Lemish, John

CEDAR RAPIDS

Univ. Eng. & Hammermills Inc. Gustafson, Carl W. Collins Radio Co. Kintzinger, Warren H.

EAGLE GROVE

Other Manseau, H. F., Jr.

FORT DODGE

U. S. Gypsum

\*Longua, Ronald H.

Welp & McCarten Inc.

Wagner, James K.

SPERRY

U. S. Gypsum Co. Brown, Thomas R.

KANSAS

ABILENE

Other Balderson, Vearie W.

BAXTER SPRINGS

Amer. Smelt & Ref. Co. Ball, Ward C. Self Employed \*Clarke, Sim S. \*Kline, Duane M. \*Schaefer, George R. \*Weidman, H. G.

Other Stroup, P. J. Stroup, Robert K. Vaught, Earl J. Weidman, H. G., Jr.

CHANUTE

Self Employed \*Hurt, E. P.

HOLTON

Other Tomerlin, Marcus M.

HUMBOLDT

Monarch Cement Co. \*Runnels, Russell T.

HUTCHINSON

The Carey Salt Co. Stone, Ronald B.

KANOPOLIS

Independent Salt Co. Hunt, Duane M.

LAWRENCE

Univ. of Kansas

"Gillerman, Elliot
King, Ralph H.
Kulstad, Robert O.
"Rankin, Frederick V.
"Smithmeyer, Frederick C.
Steffen, Robert W.
Self Employed
Nixon, Earl K.

MANHATTAN

Kansas State Univ. Sternin, Jay E.

PITTSBURG

McNally Pittsburg Mig. Corp.

\*Gilbert, Alfred G.
Lewis, Mayfield
McNally, T.

\*Mellor, Myron W.

\*Woodhead, Robert C.

Pittsburg & Midway Coal Citron, Elmer H. Lamm, Arnold E. Self Employed Lewis, E. Frank Spencer, William C.

PRAIRIE VILLAGE

Other Prince, J., Jr.

SALINA

Other Hustad, Marvin A.

Convair-Astronautics Div. Harvey, Alfred S.

WICHITA

Boeing Airplane Co.
McIntosh, Roy T.
Univ. of Wichita

\*Berg, J. Robert

\*Murphy, Daniel L.
Self Employed

\*Evans, David L.
Reigart, John R.

WILSON

Other Wilson, James W.

KENTUCKY

ASHLAND Armco Steel Corp. Todd, George H.

Other McKee, D. W. BARBOURVILLE

U. S. Bureau of Mines Parry, George W.

BENHAM

Intl. Harvester Co. Irwin, C. H. Newman, E. K Other Cole, Perry W.

CORBIN

U. S. Steel Corp. Hamlet, A. E.

DRAKESBORO

P & M Coal Mining Co. Sorrell, Sherwood W.

DRIFT

Turner Elkhorn Min. Co. Reed, Boyd F.

HARLAN

Silas Campbell Const. Co. Inc. \*Hensley, James D. Other Smith, Robert L. Yarborough, Norman

HAZARD

Virginia Iron Coal & Coke Co.

\*Eckert, A. R.
Self Employed

\*Spaiding, H. A.

Bethlehem Mines Corp.
Dittrick, A. C.
Halbert, Charles D.
\*Prunty, Marshall E.
Storey, Richard W.
Zegeer, David A.
Other Manwaring, L. G., Jr. Sewell, Henry S. Wilson, James C.

LEXINGTON

Univ. of Kentucky \*Roll, William H Spokes, Ernest M. Other Daniel, James M. Egan, Byron N.

LOUISVILLE

Anaconda Alum. Co. Lewis, Mord

Travelers Ins. Co. Kovash, Louis S. Other Carter, Carroll S.

LYNCH

U. S. Steel Corp.
Blankenship, Donald K.
Burg, Stoddard S.
Gibson, William E.
Johnston, Kenneth A.
Keefer, W. W.
Kodrowsky, William G.
Merritt, Jack A.
Moran, Archie E.
Radomsky, George
Schroder, John L.
Scrugham, Hal M.
Slone, Esra D.
Stewart, James R.
Ucciardi, F. J.
Witt, Robert, Jr.

MADISONVILLE

P & M Coal Mng. Co. Miner, James A. Paul M. Jones & Assoc. \*Jones, Paul M. West Kentucky Coal Co., Inc. Knight, Herman E.
Patterson, Moss
Self Employed
\*Donan, John G.

MARION

Kentucky Fluorspar Co. Frazer, R. N. Penn Salt Chemicals Corp. \*Tibbs, John S. West, LaMont Other Wilson, Grady A.

Me ROBERTS

Other Mercer, H. C.

NEON

Other Preston, William C.

PAINTSVILLE

South-East Coal Co. \*LaViers, Harry

PIKEVILLE

Big Sandy Elkhorn Co. Mosgrove, J. H. Webb, Arlie Other Batten, O. S. Penny, D. A.

PRESTONBURG

Beaver Creek Cons. Coal Corbin, Carl H. Prestonburg Engrg. Co. \*Reed, Charles A.

PRINTER

Other Saltsbury, H. H.

STEARNS

Stearns Coal & Lumber Co.
\*Hodge, Rex

STONE

Eastern Coal Corp.
\*Price, Vance

STURGIS

Davis Read Con. Engr.
\*Read, Davis

TILFORD

Jewell Ridge Coal Corp. Van Meter, Horace C.

WAVLAND

Evans Elkhorn Coal Co., Inc. Evans, George E., Jr. \*Howard, D. Noah WHEELWRIGHT

Inland Steel Co.
Banks, Raiph
\*Bradbury, Arthur
Fargo, Joseph R.
Gibson, Raymond W., Jr.
Grimm, Bobby M.

Indiana-Maine

Jones, Donald E. Lockin, George W. Peraino, Joseph J. Roberts, Elford H., Jr. Shockley, Richard R.

WHITESBURG

Other Allison, Blucher F.

WILLIAMSBURG

Other Gatliff, J. B., Jr.

LOUISIANA

AVERY ISLAND

Int. Salt Co. Johnson, Erland Terrell, Edward P., Jr.

BATON ROUGE

Kaiser Alum. & Chem. Co. Sparkman, James E. Louisiana State Univ. \*Cordiner, James B., Jr. Howard, C. Edward \*Sandberg, Adolph E. Other Jones, Robert L.

GRAMERCY

Kaiser Alum. & Chem. Corp. Dalton, Benjamin S. Johnson, Walter B.

NATCHITOCHES

Northwestern State Col. \*Noel, James A.

NEW IBERIA

Phipps Drill Bit Co.

\*Phipps, Orville
U. S. Navy, Civil Engr. Co.
Kieffer, Alonzo R., III Corp.

NEW ORLEANS

Freeport Sulphur Co.
Axelrad, B. A.
Feierabend, Raymond H.
Flint, Delos E. Flint, Delos E.
Lee, Clarence O.
Monroe, John E.
Schissier, John H.
Soler, Darwin
La Lux Mines, Ltd.
Molina, Eduardo A.
Plecash, John
Marine, Prod. Dept.
Keys, George W.
Natl. Lead Co.
Middleton, David M.
Other

Other

Beyer, Arthur J. Colvocoresses, A. P. Darnell, Balfour F. McCarter, W. B., Jr.

PORT SULPHUR Freeport Sulphur Co.
\*Gustafson, Arnold A.

RUSTON Louisiana Polytechnic Inst. \*Allen, Rhesa M., Jr.

SHREVEPORT

William M. Barret Inc.

"Barret, William M.
James M. Forgotson Co.
Forgotson, James M.
Self Employed

"Stevens, George R.

WEEKS

Other West, Wayne

WINNFIELD Carey Salt Co. Cooksey, Joel N.

MAINE

AUBURN

Other Cummings, John S.

# Maine-Michigan

AUGUSTA

Maine Geological Survey

\*Doyle, Robert G.
John R. Rand Inc.

\*Rand, John R.

OLD TOWN

James W. Sewell Co. \*Wing, Lawrence A.

University of Maine Howd, Frank H.

SOUTH PORTLAND

65th Ord. Detachment \*Krumlauf, Harry E., Jr.

YORK

Other Trafton, Burke O.

## MARYLAND

ADELPHI

Other Davitt, William H.

ARMY CHEMICAL CENTER U. S. Army Chem. Corp \*Jones, Stuart M., Jr.

BALTIMORE

BALTIMORE
Baltimore City Health Dept.
Sayers, Royd R.
Baltimore & Ohio R. R. Co.
Kerr, Eugene J.
Shrode, R. S.
Ellicott Mach. Corp.
Leeson, Grant
VonBolhar, Edgar Joseph
Enoch Pratt Free Library
Hart, Eugene
W. R. Grace & Co.
Harris, John M.
John Hopkins Univ.
Jett, Stephen C.
Singewald, Joseph T., Jr.
Self Employed
"McGavock, Cecil B., Jr.
Other

Dix, G. P. Keeney, James 1 Parker, Leonard James F

BETHESDA

Self Employed
 \*Tyler, Paul M. Other Killsgaard, T. H. Klugescheid, Walter P. Sloman, Harold J. Upchurch, Thos. B.

CHEVERLY

Other Franklin, R. K.

CHEVY CHASE

French Mining Mission Car, Maurice A. Self Employed \*Keiser, Hubert D. \*Maury, Jesse L. \*Richards, Owen Other Other

Corgan, Joseph A. Hughes, H. Herbert

COLLEGE PARK

U. S. Bureau of Mines S. Bureau of Mines Babcock, Clarence O. Eilertsen, Nils A. Fraas, Foster Lamb, Frank D. O'Bert, Leonard Panek, Louis A. "Schroeder, W. C. Stock, John A. Swanson, Vernon F. Williams, Roger L.

DAMASCUS

Other Gardner, C. I.

EDGEWOOD

Army Chemical Center Smith, Robert J.

FT. HOLABIRD

U. S. Army Intelligence Christie, Norman K.

HAGERSTOWN

Other Marshall, Frederic D.

HILLCREST HEIGHTS

Lepley, L. K.

HYATTSVILLE

Self Employed \*Ralston, Oliver C.

OAKLAND

Peters Fuel Corp. Peters, Franklin W.

ROCKVILLE

Flynn, George J., Jr.

SEVERNA PARK

Kennecott Refining Corp. Galbiati, D. V.

SILVER SPRING

U. S. Geol. Survey Robertson, Eugene C. Self Employed \*Houk, Lawrence G. \*Knouse, Frederick L. Heuring, Francis T. Kennedy, Donald O. May, Robert F.

SUITLAND

U. S. Weather Bureau Morgan, William A.

TIMONIUM

Other Black, Cyril L.

TOWSON

Other \*Brown, John Stafford

WESTERNPORT

Self Employed \*Hartig, Philip

WEST HYATTSVILLE

Other Anderson, Sumner M.

WHITE MARSH

United Clay Mines Corp. Breza, H. Michael

MASSACHUSETTS

ADAMS

Georgia Marble Co. Voelker, Mervin J.

AMESBURY

Callahan Mining Corp. Mahoney, R. F.

AMHERST

Amherst College Bain, George W.

AUBURNDALE

Self Employed

\*Paddison, Louis F.

\*Woods, Basil K.

BOSTON

Allis-Chalmers Mig. Co.
Everts, Robert B.
Beacon Constr. Co. Inc.
\*Ewoldt, Harold B.
\*Waltch, Mark J.
Wm. H. Coburn & Co.
\*Coburn, William H.
Copper Range Co.
Boyd, James
Goodwin, David M.
Eastern Gas & Fuel Assoc.
Granger, Graham
Keweenaw Land Assoc. Ltd.
Taylor, Carroll C.
Lomis Sayles & Co., Inc.
Hunt, Timothy J.
North Amer. Mines

Shaw, Quincy A., Jr. \*Talbot, Harold L.

S. Smelting, Ref. & Min. Co.
Duriez, Leo H.
Graves, William H., Jr.
Metcalfe, John B.

Self Employed \*Jackson, Danforth

Bradley, J. G. Brown, Davenport

CAMBRIDGE

CAMBRIDGE

Dept. of Civ. & San. Engrg.
Anthony, Michael V.

Harvard Univ.

'Bell, Peter M.
Gardner, John D.

'Gibson, Russell

'McKinstry, Hugh E.
Navias, Robert A.

'Schoen, Robert
Arthur D. Little, Inc.

'Flood, Harold W.
Glaser, Paul W.
Laffert, Frederick W., Jr.
Lane, Bruce M.

Mass. Inst. of Tech.

'Agar, Gordon E.
Chwastiak, Stephen

'deBruyn, Philip L.
Foster, F. Leroy

'Gaudin, Antoine M.

'Gillson, Joseph L.

'Hurley, Patrick M.

'Parks, Roland D.

'Romankiw, Lubomyr T.

Simpler Wire & Coble Co.

\*Romankiw, Lubomyr T.
Simplex Wire & Cable Co.
Burns, William
Shepherd, Alfred H.
Smith, Calvert

CANTON

Emerson & Cuming, Inc. \*Lefforge, John W.

CARLISLE

Other McAllister R. W

CHESTNUT HILL

Boston College \*Skehan, James W.

COCHITUATE

Self Employed \*Pechet, Meleo S.

COLRAIN

Other Donelson, Robert L.

HINGHAM

Other Edwards, Theo A.

HOLDEN

Other Clarke, Robert J.

LINCOLN

Borcherdt & Smith \*Smith C. DeWitt

MARBLEHEAD John B. Breymann Co. \*Breyman, John B., III

MILTON

Curry College \*Faizi, Salih

NABNASSET

Other Fletcher, E. Kennard

NEWTON

Self Employed \*Ladoo, Raymond B.

NEWTONVILLE

Jarrell-Ash Co. \*Jarrell, Oscar W.

NORWOOD

Other Gillis, J. J.

OHINCY

Eastern Engrg. Sales Co. Smith, J. LeRoy

SEEKONK

Other Wilson, Carroll L.

SO. HADLEY FALLS

Other Gallemore, W. A.

SOUTH WALPOLE

Bird Machine Co. Northcott, Elliott Shepherd, Henry H. White, William F.

SPRINGFIELD

Other McIntosh, Roy T.

WABAN

Other Moore, Carl F.

WALTHAM

N. E. Div. Corp. of Engrs. \*Gurley, Robert C.

WELLESLEY HILLS

\*Douglas C. B. E. Thurrell, Robert F., Jr.

WEST CAMBRIDGE

Arthur D. Little Almeida, A. Robert

WEST CHELMSFORD

H. E. Fletcher Co. Fletcher, R. Andrew, Jr. Fletcher, Ralph A. Mould, Channing B.

WESTFIELD

John S. Lane & Son Moore, Milton D., Jr.

WINCHESTER

Other Newton, Roger H.

MICHIGAN

ALABASTER

U. S. Gypsum Co. Van Ornum, M. H. ALPENA

Other

Allen, Robert H. ANN ARBOR

Univ. of Mich.
Boyer, William H.
\*Cloke, Paul L.
\*Helnrich, E. Wm.
\*Johnson, Alvin C., Jr
Kraus, Edward H.
\*Landes, Kenneth K.
Perhac, Ralph M.
Turneaure, F. S.
\*Williams, Brymer G.
\*York, J. Louis
Other . Jr.

Other Wilson, James T.

BENTON HARBOR Other Barnes, Parry

BERKLEY

Other Carroll, James C.

BESSEMER

Puritan Mining Co.

\*Helge, Ellis C.
Self Employed

\*Forslund, Evar J.

Calumet & Hecla, Inc. Benedict, C. Harry

Dashine, Paul Kuchta, Ernest M. Lasio, John Pierce, Robt. L. Pollock, James P. Foliock, James P.
Schillinger, Alvin W.
Tatman, Charles R.
Vitton, John J.
Weege, Randall J.
Self Employed
\*Broderick, Thomas M.
Other

Other Boorman, Alfred C., Jr. \*Wohlrab, Aloys H.

CASPIAN

Pickands Mather & Co. Bailey, Carlton D. \*Martini, Arthur A.

CEDARVILLE

U. S. Steel Corp. Ranson, William R., Jr.

CENTER LINE

Otac Dept. of Defense \*Keenan, Emil B.

CRYSTAL FALLS

Inland Steel Co.
Ahl, Wayne J.
Other Hagglund, Walter E. Lien, Russell A. Pardee, Franklin G.

DEARBORN

Ford Motor Co.

\*Apple, Foster L.
Bodor, Robert L.
Trethewey, Ben C. Other Tyler, W. W.

DE TOUR Drummond Dolmite, Inc. Gabel, Gerald R.

DETROIT

DETROIT

Allegheny Ludium Steel Corp.

"Graham, James A.

Detroit Public Library
Uiveling, Raiph A.

Fargo Mach. & Tool Co.
Haworth, Roy D.
General Motors

"Michelson, John A.

Intl. Salt Co.

"Jacoby, Charles H.
"Read, Leo E.
"Peyfuss, Kut F.
U. S. Army
Greiner, R. Peter
U. S. Lake Survey Co.
Leonard, Donald J.
U. S. Steel Co.
Campbell, Lloyd S.
Ferguson, Herman W.
Wheel Trueing Tool Co.
"Adamson, Patrick
Pickard, A. Frank
Self Employed
Heron S. D.

Other
Bruce M. Bertram

Other

Bruce M. Bertram Margenau, Roy E. EAST LANSING

Michigan State Univ. Cummings, David \*Gurnham, C. Fred \*Zinn, Justin

GALESBURG Other

GRAND RAPIDS AMI, INC. Haddock, John W. Bestwall, Gypsum Co. \*Sager, Ronald L.

Becker, D. Dallas

GROSSE POINTE

Other Hoover, Walter M.

HANCOCK

Michigan College \*Nigro, John C. Other Keck, Walter E. Landstrom, Arnold B. Reeder, J. Harry

#### HAZEL PARK

Jered Ind. Foreman, Charles G.

# HOUGHTON

Cram & Co. Schubert, Geo. P. Mich. College of Mining & Mich. College of Mining of Tech.

\*Adler, Lawrence
Bacon, Lloyd O.
\*Beebe, Robert R.
\*Been, Walfrid
Cho, Maung M.
\*Doane, Virginia L.
Fisher, James
Frantti, Gordon E.
Harry, Chas. M.
\*Hockings, William A.
\*Kennedy, Allen D.
\*Kerekes, Frank
Michaels, Ellery L.
\*Neilson, James M.
\*Snelgrove, Alfred K. Neilson, James M.

Snelgrove, Alfred K.

Spiroff, Kiril

Thayer, Duane M.

Van Pelt, John R., Jr.

Volin, Melden E.

Other
Jallo, Tejan A.
Manderfield, N. H.
Tolonen, Frank J.

#### IRON MOUNTAIN

Ford MOUNTAIN

Ford Motor Co.
Kral, Victor E.
M. A. Hanna Co.
Geist, Elton W.
Lee, Floyd H.
Peterson, Charles E.
\*Smith, Richard R.
Sougstad, Edward E.
Sullivan, Paul G.
Lake Shore, Inc.
Clark, James W.
Greenly, John R.
Jamar, John W.
W. B. Thompson Co.
Berg, W. Barton
Thompson, Wallace B.
Other Oth her Frendewey, James O. Hecker, Thomas C. Johnson, Emmett G. Kotonias, George Reeve, B. W. Shaughency, H. C.

# IRON RIVER

IRON RIVER

City of Iron River
Reed, William Philip
Dewald Engineering
"Dewald, W. E.
M. A. Hanna Co.
Bratt, John M.
Hagen, John C.
Koehler, George A.
Kuehithau, Kurt R.
McAuliffe, John D.
Remarcke, George R.
Zimmer, Paul W.
Inland Steel Co.
Edwards, Robert W.
Nesbitt, Robert H.
The Miners State Bank
Kreski, Edward J.
Odgers Drilling, Inc.
Nelson, Marlowe A.
Odgers, Ira D.
Other
Nell Harrie A.

Other Neil, Harris A. Skorseth, Robert A.

# IRONWOOD

Mauthe Mining Co.

\*Cigallio, Al. J.
Pickands Mather & Co.

\*Johnson, A. L.
Petersen, Roy I. Price, Leslie E. Wangaard, John C. U. S. Army LaBlonde, George T., Jr.

Other Fountain, William G. Knoll, Waldemar A. MacDonald, K. A.

# ISHPEMING

Cleveland-Cliffs Iron Co. Anderson, Gerald J. Anderson, O. J. Berkhahn, Robert W. \*Campbell, D. Kelly Erck, Louis J. Frickson, Lee

Johnson, Edwin B.

\*Kauppila, T. A.
LaBelle, Robert J. B.
Lindroos, Emert W.
\*Magnuson, Raiph E., Jr.
Marincel, Joseph M.
Marjama, Onnie
Randolph, E. Richard
Rex, Eric J.
Sundeen, Stanley W.
Swanson, Harry C.
\*Winslow, Kenelm C.
Inland Steel Co.
Annear, Richard C.
Broderick, Alan T.
Brown, Douglas E.
Metzger, Vern E.
Pearson, Philip D.
\*Satterley, Raymond D.
Other

Adwar John W. Johnson, Edwin B.

\*Satterley, Other Adams, John W. Derby, Edwin L. J Jackson, George R. Lemay, Donald B. Meyers, James P. Ohlson, John M.

## KALAMAZOO

Other Ames, Hoeard E.

### KINGSFORD

Other Hall, Roger

# LAKE LINDEN

Other Treeoning, R. A.

# LAURIUM

Other Poull, Robert K.

# LINCOLN PARK

Ford Motor Co. Basler, Wayne G. Other Ege, John R.

# MADISON HEIGHTS

Boston, Richard R.

# MARQUETTE

Klumb, Ronald G. McKichan, John D.

# MENOMINEE

Freeport Sulphur Co. Norcross, Fred S. Jr.

Dow Chemical Co.
Cardwell, Paul H.
Gould, Wayne D.
Kuchinic, Robert M.
Lokken, John C.
McCarty, Merrill F.
Underwood, Delos A.
Kaiser Aluminum & Corre Chem. Corp. Stephens, Robert W. Other Anderson, Raymond J.

# MT. PLEASANT

Mineral Mining Co.
\*Brown, William F.

# NEGAUNEE

Com-Tronics, Inc.
Burridge, Charles K.
Jones & Laughlin Steel Corp.
\*Avery, John W.
Balconi, Russell L.
\*Benson, Wm. A.
Braund, Robert W.
Hays, Ronald M.
Karkkainen, C. W.
Purdy, Clifford J.
North Range Mining Co.
Archibald, Ralph S.
Archibald, Robert
\*Haller, F. J.
Other

Other Barrett, L. P. Boyum B. H. Hakala, Oiva W. Korpinen, Hugo H. Koski, Ray Andrew

# PL.VMOUTH

Evans Products Co. \*Bedford, John P.

# REPUBLIC

Cleveland-Cliffs Iron Co. Crites, Joseph D.

# RIVER ROUGE

U. S. Gypeum Co. Kebel, Harlan L.

# ROGERS CITY

U. S. Steel Corp. Baker, Ralph L. Suliot, Jack N.

# SAINT LOUIS

Mich. Chem. Corp. Marvin, Theodore Whitman, Judson H. Laczynski, Edw. M.

# SAULT STE MARIE

Mich. College of Mining & Tech. \*Kemp, C. Ernest

#### SOUTHFIELD

Sterling, Donald L.

# ST. CLAIR SHORES

McLaughlin, Wm. R.

## TRENTON

Other Castner, Thomas J.

# UNION PIER

Dibble, Robert D.

# WAKEPIPLD

Other Whiton, R. W.

# WARREN

General Motors

homson, Robert F. WHITE CLOUD

# Maranz, David E.

WHITE PINE

White Pine Copper Co.

\*Edwards, George H.
Elizondo, Joseph B.
Fritts, John J.
Gamble, Ross E.
Garfield, Lawrence A.
Leone, Ray J.
Lessels, Virgil
Lukkarila, Wait O.
Michels, Frederick G.
Moore, Robert L.
Mukavitz, David R.
\*Reeder, Robert T.
Schmucker, Thomas W.
Taipale, James M.
Thaler, Julio H.
Other
Nichelle, We. S.

Other Nicholls, Wm. P.

# WYANDOTTE

Wyandotte Chemicals Corp. Piper, Thomas B.

# MINNESOTA

# AURORA

Neubauer, Robert G.

# BARRITT

serve Min. Co.
Bertie, Raymond J.
Carlson, Douglas E.
Howell, Sidney C.
McIntire, Fayette E.
Moyer, Allan M.
Pastika, Joseph Other Ahlquist, H. R.

# BEMIDJI

Other Battles, Leon E.

# BIWABIK

Pickands Mather & Co Stetson, Harland J.

Pioneer Min. Co.
\*Bergstrom, Frank S.
Henderson, William T.

#### BOURY

Oliver Iron Mining Scipioni, Louis

# BUHL

Other Baker, John J. Betzler, Wm. F.

# CALUMET

Jones & Laughlin Steel Corp.
Abercromble, Russell L.
Eastman, Eugene A.
Lemke, Laverne
Simons, Gaylord D.
\*Strande, Julius A.
Other Other Eilertson, George A.

# CHISHOLM

Inland Steel Co. Johnson, Wesley G. Sherman Mine, Oliver Mining Div.
Forsmark, M. J.
Snyder Min. Co.
Axelson, Oliver A.
Barker, Theodore J.
Coen, Kenneth P.
Ekar, Rudolph A.
Erkkila, Mauri E.
Hoag, Max C.
Jensen, Frederick T.
Rudstrom, Chas. O.
Zobitz, Edward
Other

Other

Crescenzo, Peter J. Mario, Neil C. Wallace, Robert R.

# COLD SPRING

Cold Spring Granite Co. Alexander, John C.

# COLERAINE

The Cleveland-Cliffs Iron Co. Pearson, Ronald B. Oliver Iron Ming. Div., U.S. Steel Steel
Althouse, John G.
Fowler, J. Alan
Harrison, John Henry
U. S. Steel Corp.
Dalke, Wayne L.
Viking Oll Co.
"Whitney, R. W., Jr.
Other
Ahola, Vernon
Matson, Amel E.
Savage, Alfred F.
Unger, Harold F.

# COOLEY

M. A. Hanna Min. Co. Faust, Herbert H.

# CROSBY

M. A. Hanna Co.
Engel, Fred K.
Noble, Duane H.
Inland Steel Co.
\*Tweed, Thomas M.
Self Employed
\*Kangas, Adam W.
Van Evera, James W.
Other Other Simmons, John J., Jr.

# DEERWOOD

Other Chilton, Dan R.

# DULUTH

Allis-Chalmers Mfg. Co.
Schnaufer, Arthur E.
American Steel & Wire Div.,
U. S. Steel
Moore, LeRoy W.
Atkins-Walker Co.
\*Walker, Harry C.
The Congdon Office Corp.
Congdon, Robert
Conveyor Belt Service, Inc.
\*Mars, William A.
E. I. du Pont de Nemours &
Co.

Co.
Surrett, Edward J.
Eimco Corp.
Dunyon, Albert F. \*LaGrange, M. D., Jr. Exploration & Develo Co. Adams, Robert M.

# Michigan-Minnesota

First American Natl. Bank

Frederickson, Walter L.
Hercules Fowder Co.
Hansom, Willis E.
The Higgins Office
Higgins, Raymond J.
Joy Mfg. Co.
Lockhart, Allan J.
MacCallum, Arthur A.
Lake Shore Inc.

Shepard R. S.
Mathiesen Tire Co.

Lake Shore Inc.

\*Shepard R. S.
Mathiesen Tire Co.
Sibley, Frank H.
Mesabi Mineral Assoc.
Pearsall, William G.
W. S. Moore Co.
Everett, Jack V.
Moore, Irving F.
Moore, Warren S.
Slaughter, William F.
Nordberg Mfg. Co.
Crandall, John W.
North Western-Hanna

\*Crawford, John T.
Oglebay Norton Co.
Torreano, August F.
Oliver Iron Mining Div., U. S.
Siteel
Anderson, Jule R.

Stiel
Anderson, Jule R.
Axelson, A. Herbert
Bailey, Chas. N.
Bennetts, Robert L.
Bennetts, William H.
Beukema, Christian F.
Bradley, Stuart V.
Byers, Richard R.
Cotter, William E., Jr.
Perby, Richard A.
Dick, Leslie E.
Duhling, William H., Jr.
Erspamer, E. G.
Friedman, Edwin A.
Hendrickson, Luther G.
Hustad, James B.
Iverson, Cedric L.
Johnson, Everette D.
Johnson, Thys B.
'Knutson, Arnold R.
Langer, Robert J.
Learmont, Robert P.
Lopez, Roger D.
Marsden, Ralph W.
Matheson, William N.
'Mielke, Morris V.
Moberg, Norman A.
Morton, Ronald J.
Moyle, Robert M.
Murkve, Jerome G.
'Oja, Ralph K.
'Palusky, Eugene L.
'Pell, George H.
'Rathbun, Grove A., Jr.
Reid, Ian L.
Ryan, Kenneth H.
'Scipioni, Bruno
'Steel, James S.
Pickands Mather & Co.
Anundsen, Erling A.
Beard, Richard C.
Chisholm, Donald M.
DeVaney, Fred D.
Duncan, Kenneth
Joppa, Everett L.
Stunkard, Bruce W.
Republic Steel Corp.
'Cash, F. H.
Robert M. Adams Co.
Adams, Robert M., Jr.
'S. Burcan of Mines

Adams, Robert M., Jr.
U. S. Bureau of Mines
Look, Allen D.
U. S. Steel Corp.
\*Palasvirta, Ossi E.
Zeller, George C.
H. E. Westmoreland, Inc.
\*France, Alfred E.
Zenith Iron Min. Co.
Sellwood, Joseph G.
Self Employed
Dudley, Harry C.
Hakala, Harvey J.
\*Roberts, Hugh M.
\*Scofield, Lloyd M.
Other

her
Alworth, Royal D., Jr.
Anderson, Ernest J.
Andreachi, John R.
Brewer, Carl
Brewer, Richard
Burton, Carlyle R.
Connolly, Lewis
Diehl, G. E.
Ferris, John A.
Harkins, Wesiey R.
McEachin, John L.
Myers, Henry F.
Nelson, Albert O.
Peterson, Andrew Y. Other Nelson, Albert O.
Peterson, Andrew Y.
Spencer, Geo. H., Jr.
Strong, Richard
Taylor, James L.
Thielman, T. C.
Werther, F. R.
Wolff, J. Frederic, Sr.
Young, Frank A.

# Minnesota-Missouri

Bolitho Engineering Office

\*Bolitho, Edward C.
Oliver Iron Ming. Div., U.S.
Steel
Erickson, William T.
Hestetune, Daniel G. Other Berkner, D. A.

#### EVELETH

Eveleth Fee Office

\*Campbell, Vernon R.

\*Munter, Vanner J.

St. Louis Co., Peat Products Co. Maki, John O.

# FINLAND

Self Employed \*Machamer, Jerome E.

# GRAND RAPIDS

J. & L. Steel Corp. Hake, Francis D. Seaberg, Adolph C. Werner, Robert F. Other Belobraidich, W. J. Simon, James A.

#### HIBBING

F. H. Bathke Co.
Sweningson, Nenfred C.
The Cleveland-Cliffs Iron Co.
\*Bell, Orin R.
\*Foucault, John J.
Hanson, Lauren K.
Hill, Arnold E.
Svigel, Wm. H.
Viant, Melvin L.
Continental Sales & Equip.
Co.
McElvain, Richard E.
Scott, Donald W.
Great Northern Iron Ore
Properties

Iver Iron Mining D.
S. Steel
Bailey, Carlton D., Jr.
Beebe, Wayne W.
Gilmore, Emmett M.
Hansen, Lloyd B.
Hearding, John H., Jr.
Lerohl, Iver R.
MacAlpine, Kenneth F.
Meyers, Donald H.
Mohr, Thomas C.
Olson, Reuben L.
Segar, Raymond W.
Sermon, Milton R.
Stewart, William G.
Stone, Elmer G.

Suihkonen, John A.
Van Delinder, Marion D.
Vik, Richard A.
Waller, Paul R.
Pacific Isie Min. Co.
Tuomala, Arne O.
Pickands Mather & Co.
Basso, John A.
Childs, Mary-Hill
Merklin, Kenneth E.
Nyhus, John W.
Veith, David L.
Webb, Wm. D.
Pittsburgh Pacific Co.
Boenie, John D., Jr.
Kimball, Donald C.
Vellella, Anthony T.
Rhude & Fryberger
Fryberger, William B.
U. S. Steel Corp.
\*Koenen, Albert T.
Western-Knapp Engrg. Co.
Archambeau, James J.
Heilman, Joseph C.
Mund, Edward W.
Richards, William F.
Western Machinery Co.
MacKnight, Donald E.
The Zeco Co.
Shefchik, David R.
Self Employed
\*Wolff, Werner P.
Other
Barber, Max H.

Other

her
Barber, Max H.
Barrett, F. C.
Bassett, R. H.
Calvin, C. J.
Chisholm, John Chisholm, John
Clevenstine, R. I.
Heiland, Norman G.
Hemmersbaugh, R. G.
Jamar, Dwight W.
Koskinen, Feter K.
\*Linden, John F.
Lipovetz, Gerald
Madsen, J. M.
Madson, Dick L.
Pickering, H. M.
Rhude, James E.
Rhude, Jens, O.
Richards, B. S., Jr.
Rockwell, S. A.
Young, E. A.

Co.

McElvain, Richard E.
Scott, Donald W.
Great Northern Iron Ore
Properties

\*Baehr, Richard E.
Watson, William W.
The M. A. Hanna Co.
\*Adamson, Marvin K.
Andreas, B. M.
Beckman, Charles A.
Bonicatto, Lawrence P.
Buck, Robert O.
Bunge, Fred E.
Dyson, Fred E.
Dyson, Fred E.
Dyson, Fred E.
Jr.
\*Erickson, Stephen E.
Glumae, George
Klatsky, Stephen S.
Koski, Eino O.
Mattson, George A.
Meli, C. James
Morrow, James B.
Rother, Jack
Wakeman, John S.
Hardinge Co., Inc.
Dicke, Peter C.
Ferguson, R. C.
L & Madiator Co.
\*Chisholm, John A.
Langer Equip, Co.
\*Spencer, R. Robbins
Lerch Bros., Inc.
\*Lerch Glen B.
Abe W. Mathews Engrg. Co.
Banke, Joseph J.
\*Mathews, Abe W.
Meriden Iron Co.
Aronson, C. W.
Bennett, Joseph C.
\*Stuart, James R.
\*Torreano, Peter F.
Resabs Service & Supply Co.
\*Taylor, William L.
Resabl Mineral Assoc.
Mayer, Christian J.
Minn. Div. Lands & Min.
Cicchi, David P.
Rafn, Elwood F.
W. S. Moore Co.
\*Binon, Layton C.
Northern Mining Equip. Co.
Gribble, Robert Q.
Oliver Iron Mining Div.
U. S. Steel
Bailey, Carlton D., Jr.
Beebe, Wayne W.
Gilmore, Emmett M.
Hansen, Lloyd B.
Harden Jones Co.
Richards, B. M., Young, E. A.
Young, E.
Rhude, Jens, O.
Bauran, William HOYT LAKES

Erie Min. Co.
Bauman, William S.
Sandvig, Morris E.
Williams, Charles J.
Berge, O. T.
Borgeson, Oliver W.
Brebner, Elliot J.
Bymark, John V.
Carlson, Arnold J.
Daughney, Vernon F.
DeVaney, Daniel S.
Farrell, Robert H.
Groll, Kenneth R.
Hockin, E. Bruce
Hovland, Mark L.
"Marincel, George M.
Marr, William N. Jr.
Matson, Charles L.
Stensrud, Roacoe W.
Thaler, Albert B.
"Tittman, David W.
Tuttle, Wayne H.
Pickands Mather & Co.
Bell, Robert W.
McDermott, William F.
Whaley, Henry P.
Other
Brown, Hamilton P.

# MARBLE

Cleveland-Cliffs Iron Co.

"Hutchings, Louis E.
Great Northern Iron Ore
Properties

"Johnson, Axel L.
Lehtola, Evert M.
Oliver Iron Ming. Div., U.S.
Steel \*Bolton, Hubert F. Other Jones, Richard D.

MAZEPPA

Other Searles, John N.

# MINNEAPOLIS

MINNEAPOLIS

Archer-Daniels-Midland
Lentz, Thomas H.
Bennett Office Inc.
Bennett, Russell H.
Foundation Maintenance &
Service Co.
\*Nelson, Arthur M.
General Mills, Inc.
Terry, David E.
Ingersoll-Rand Co.
\*Culbertson, Francis D.
Al Johnson Const. Co.
Anderson, Neil L.
Lindgren & Lehmann
\*Lehmann, Ernest K.
Lind Belt Co.
Lovrien, James K.
E. J. Longyear Co.
Burnhart, Vincent N.
\*Donovan, Percy W.
Eastman, Walter R.
\*Gebhardt, Rudolph C.
Gleason, Michael J.
Kurtz, Harry A.
Larson, Eugene
Longyear, Robert D.
Miller, J. R.
\*Sorensen, Bryan F.
R. L. Loofbourow
\*Loofbourow, Robert L.
\*Parker, Jack
Manganese Chem. Corp.
Babbitt, Bernard R.
Meriden Iron Co.
Ferris, Wallace F.
Kampmeyer, John J.
Minneapolis-Honeywell Reg.
Co.
Bierman, Roy J.
Montana-Dakota Utilities Co.

Minneapolis-ravaCo.
Bierman, Roy J.
Montana-Dakota Utilities Co.
Smith, Cecil W.
The Pillsbury Co.
"Gracza, Rezsoe
Pitsburgh Pacific Co.
"Harrison, Hugh H.
U. S. Bureau of Mines
Colombo, Arthur F.

\*Harrison, Hugh H.

U. S. Bureau of Mines
Colombo, Arthur F.
Delzer, Francis X. R.
Fine, Morris M.
Grosh, Wesley A.
Marovelli, Robert L.
Needham, A. B.
Rand, Lenox H.
Rushton, Tom N.
Sorensen, Roy T.
Univ. of Minnesota
\*Bleifus, Rodney L.
Cooke, S. R. B.
\*Dorenfeld, Adrian C.
\*Gnirk, Paul F.
\*Gundersen, James N.
Nolte, Julius M.
\*Pfielder, Eugene P.
Robinson, Alan W.
\*Schulz, Norman F.
\*Schwartz, George M.
Wade, Henry H.
\*Weaton, George F., Jr.
Woozleki, Antoni
Yardley, Donald H.
Warben Land Co.
Gaarden, Alice R. Warren
Winston Inc.
Blackmore, J. H.
\*Gail, Charles P.
Self Employed
\*Adams, Salisbury
\*Gerow, Theron. G.
Other
Bartell, Henry L.

\*Gerow, Theron. G.
Other
Bartell, Henry L.
Bennett, T. W.
Calhoun, Allan B.
Gustavson, S. A.
Hansen, Mayer G.
Schneider, Darrell F.
Schultz, Clifford W.
Wagner, Willard J.
Wasson, Paul A.

# MT. IRON

Oliver Iron Mining Div. of U. S. Steel Corp. Anderson, Roger G. Forciea, James E. Salmi, Robert W. Pacific Isle Mining Co. Hart, Henry M. Lacke, Robert J. Other

# NASHWAUK

M. A. Hanna Co Dagg, Calvin E. Dicks, Mason L. Englund, Arthur E.

Bingel, John P.

Kauti, Eino A. Knapp, Vaughn R. Martinson, Ronald M. Nelson, Donald K. Oss, Donald G. Owens, John S. Wick, Dave E. Wickman, Robert A.

Other Larson, Harry A. Leclair, William M.

## PENGILLY

Other Willard, Paul D.

# RIVERTON

Manganese Chem. Corp. Peterson, Donald W.

# ST. PAUL

F. H. Bathke Co.
Bathke, Alfred S.
Butler Ore Co.
Butler, Wallace P.
Great Northern Iron Ore Butler, Wallace P.
Great Northern Iron Ore
Properties
Ray, Philip L.
Iron Ranges Nat. Gas Co.
Warhol, Peter
Lindgren, & Lehmann
"Lindgren, Donald W.
Minn. Highway Dept.
Berndt, Donald M.
Minn. Dept. of Taxation
"Berry, Charles W.
Minn. Min. & Mig. Co.
Brown, John A.
Cadwell, Donald E.
Collins, Robert C.
Goldsmith, Millard C.
Minn. State of Lands & Min.
Nolan, Ray D.
Pascoe, Roy C.
Northern Pacific Ry. Co.
"Hogberg, Rudolph K.
"Powe, George R.
"Thurlow, Ernest E.
Ramsey Engr. Co.
Cahill, Robt. C.
U. S. Bureau of Mines
Terichow, Oleg
Other
Austin, Orrin

Other ner Austin, Orrin Chew, Randall T., III Lever, Harold Allan Moll, A. Donald

# ST. PAUL PARK

Carmichael, Virgil W.

# ST. PETER

Hallett Const. Co. Howes, John R.

# SILVER BAY

Reserve Min. Co.
Apull, Wayne E.
Banovetz, Matthew R.
Bryant, J. Wm.
Cooksey, Donald E.
Davis, Edward W.
Grabow, William D.
Haley, Kenneth M.
Lampman, E. C.
Linney, Robert J.
Pearson, William P.
Reed, Richard L.
Reynolds, James A.
Schmid, Edward A.
Virant, Carl W.
Woodle, Merlyn G.

Other Furness, Edward M.

# TACONITE

Cleveland-Cliffs Iron Co. Stukel, James \*Van Slyke, William R.

# VIRGINIA

H. T. Caddy Cons. Mining H. T. Caddy Cons. Mining Engineer

\*Caddy, Howard T. Dorr-Oliver Inc. Keller, Leon D. Dow Chemical Co. Grant, Charles H. Kahler, Don S. Edwards Mine & Mill Co. Sulentich, Karl F. Hoover Const. Co. Johnson, Peter J.

\*Moore, Russell C.

Johnson & Moore Inc.
Smith, Lawrence E.
Jones & Laughlin Steel Corp.
Durocher, Roland E.
Gaspar, William F.
Gross, Joseph R.
Hautals, Robert L.
Kealy, Charles D.
Kullberg, Harry F.
Miche, Thomas A.
Moen, R. Roger

\*Stephenson, Thomas E.
Hodil, LaVerne E.
Oliver Iron Mining Div.
U. S. S.

Oliver Iron Mining Div.
U. S. S.
\*Bakkila, Henry E.
Erickson, Arthur C.
Erickson, Donald V.
Freeman, Donald B.
\*Gibbens, David D.
Hartley, David
Hill, David H.
Johnson, Marvin E.
\*Martin, John M.
Muckler, Donald B.
Skubic Bros. Co.
Skubic, Frank J.
Other

Other her Aho, Lyle E. Arpi, William A. Chase, Paul W. Davidson, Ferman V. Handberg, Peter N. Knudson, John R. Rubow, Irvin H.

#### WINONA

Brom Machine & Fdry. Co. \*Brom, Leo J. T.

# MISSISSIPPI

COLUMBUS

Other Carter, William H.

HATTIESBURG

Self Employed \*Brown, Bahngrell W.

# JACKSON

Concrete Division, WES Mather, Katharine K. Filtrol Corp. Millice, Carl T. Other Johnson, Eugene W.

# OCEAN SPRINGS

H. K. Porter Co.
\*Vervaeke, Robert G.

# VICKSBURG

Southwest Potash Corp. Smith, W. Aubrey

# MISSOURI

BELTON.

Other Key, John A.

# BONNE TERRE

BONNE TERRE

St. Joseph Lead Co.
Anderson, Searles T.
Bilhelmer, Lee
Bullock, Richard L.
Casteel, Lawrence W.
Clifford, Thomas J.
\*Cox, Kenneth R.
Cummings, Bradford C.
Duffy, Walter D.
Ferguson, Gerald L.
Grout, C. MacDonald
Haug, Edward J.
Hoffman, Herbert A.
Jones, Elmer A.
Lane, Marvin E.
Mann, C. David
Monroe, Harley L.
\*Morton, Thomas R.
Odell, James W.
Redfield, Francis F.
Robertson, David
Schumacher, Richard L.
Snyder, Frank G. Robertson, David Schumacher, Richard L. Snyder, Frank G. Stockett, N. A. Turley, Lovell L. 'Ventimiglia, Vincent J. Wagner, Richard E. Weigel, W. W. Wolf, E. Hugo ther Other

Bartholomees, Geo. C. Weber, John E.

BRENTWOOD

Other Lake, T. R.

CAPE GIRARDEAU

Southeast Missouri State College Parkinson, Robert W.

Allis-Chalmers Mfg. Co. Smay, Byron K.

COLUMBIA

Univ. of Missouri Keller, Walter D. Other \*Wolfrom, Warren J.

DESLOGE

Grigsby Valve Co Grigsby, Gail Glyn

De Soto Mining Co. Thompson, J. Marshall

FARMINGTON

Hanna Mining Company Leney, George W. Other Clark, M. L.

FLORISSANT

Other Desloge, Joseph, J Tousley, G. H., Jr

FORT LEONARD WOOD

S. Army Bradley, R. C. Schwenk, Franklin C. Steele, Gordon L.

FREDERICKTOWN

National Lead Co. \*Krueger, Harold A.

\*Niedermeyer, Oscar David
Self Employed

\*Morris, Thomas Q.
Rood, J. A. Other Smith, C. T.

GLENDALE

Hicks, Thomas A.

HANNIBAL.

U. S. Steel Corp. Henning, Mike M.

HAZELWOOD

Gardner-Denver Co. Bird, John C.

INDEPENDENCE Missouri Portland Cement Co. Seiwald, Donald J.

IRON MOUNTAIN

Midwest Ore Co. Erpenbach, Lloyd J. Murphy, John E. IRONTON

American Smelting & Refining

Co. Bowditch, Samuel I. Grenia, James D. Morrison, Bert C. Staves, Harold T. Midwest Ore Co. Matson, Robert P.

**JENNINGS** 

Muldrow, Howard K.

JOPLIN

Amer. Lead, Zinc and Smelt Co. Netzeband, William F.

Stewart, Daniel R.
N. Bendelari
Bendelari, Fred N.
I. du Pont de Nemours & Cash, Robert O.

The Eagle-Picher
Hamilton, Paul R.
Harner, Harold R.
Harner, Harold R.
Illidge, R. E.
General Steel Products Co.
Kirk, Whitson J.
Minerals Beneficiation Inc.
Rakowsky, Victor
Weidman Industries
"Weidman, Thomas H.
Harold H. White
"White, Harold H.
Bruce Williams Labs.
"Jones, Philip L.
"Villiams, Bruce
Self Employed
"Fowler, George M.
Lyden, Joseph P.
Other

Other Gray, Howard O. Gray, Howard O. Nixon, Virgil H. Plumb, Cariton H. Sheeran, Harold Wm. Stewart, Wm. M. Wallower, F. C.

KANSAS CITY

Armco Steel Corp. Armco Steel Corp.
Bard, A. L.
Souder, Arnold
KW-Dart Truck Co.
Clayton, Walter C.
Electrofrac Corp.
"Saraput, Erich
Spencer Chemical Co.
"Haley, Ted D.
Thomas, Christopher Y.
Watkins, Dick R.
U. S. Army Corps of
Engineers Engineers Audsley, Glenn L. Other Jung, Frederic W.

KIRKWOOD

Williams Pat. Crusher Co. Braun, August L. Other McCallum, Jean Murrill, Randall T. O'Loughlin, Ivan

MEXICO

Kaiser Al. & Chem. Corp. \*Fleshman, Howard G. Weigel, Robert C. Miller Mining Co. Miller, R. Lary

MINERAL POINT

Milwhite Mud Sales Co. \*Devitt, William

MONTGOMERY CITY

General Refractories Co. Pace, Charles R., Jr.

NEOSHO

Southwest Lime Company \*Hunt, Russell W. Other Swanson, Kenneth A.

ORONOGO

Oronogo Mutual Min. Co. Waring, Guy H.

OVERLAND

Other Moulton, Bernarr G.

POTOSI

Midwest Mining Co.
Hanson, William L.
Missouri Cliffs Inc.
Adair, Donald L.
National Lead Co.
\*Achterberg, Ernest R.
Houk, Clarence C.
Sackett, Earl L. H.
St. Joseph Lead Co.
Kiser, John E.

RICHMOND HEIGHTS

Mid-Continent Exploration Ensign, Chester O., Jr.

RIVERMINES

St. Joseph Lead Co. Koen, Harold L. Wykoff, B. T. Self Employed \*Pressler, Louis P. ROLLA

issouri Geological Survey
\*Beveridge, Thos. R.
\*Hayes, William C.
issouri School of Mines
Almstedt, Charles R.
\*Amstutz, G. Christian
\*Ash, Richard L. Min \*Amstutz, G. Christian
\*Ash, Richard L.
\*Brownlow, Arthur H.
\*Bruzewski, Robert F.
\*Bush, Arthur J.
Caudie, Rodney Duane
\*Christiansen, Carl R.
\*Clark, George B.
Fruzan, Faramarz
\*Grawe, Oliver R.
\*Legadin, Adolph
\*Morgan, Ray E.
Proctor, Paul D.
Randoloh, Earl J.
Stinnett, Landy A.
\*Thompson, Dudley
\*Wilson, Curtis L.
\*Worley, Morris T.
\*Zimmerman, Richard A.
U. S. Bureau of Mines
Chester, John W.
Kenworthy, Heine
Miller, William C.
Other

Marosek, Charles F. Travis, R. G.

ST. CHARLES

Stourton Surveying Co
\*Stourton, George E.

ST. GENEVIEVE

Mississippi Lime Co. Fieg, Lothar

ST. LOUIS

American Cyanamid Co.
Lowe, R. H.
Amer. Managanese Steel Div.
Black, W. M.
Kelley, R. F., Jr.
Amer. Zinc, Lead is Smelt. Co.
\*Ammon, Robert I.
\*Calhoun, Ralph E.
Calhoun, Ralph E.
Calhoun, William M.
Cotterill, Carl H.
Currie, John W.
\*Dobbel, Chas. A.
Griffiths, John R.
Meek, Fred J.
Atlas Copco Inc.
Forster, Eugene C.
Simmering, Stanley K.
C. Kremer Bain
\*Bain, C. Kremer
Bendy Engineering Co.
\*Bendy, W. R.
Boyles Bros. Drilling Co.
Sainsbury, Ferris E.
Central Mine Equipment Co.
Rassieur, T. E.
Central Mine Equipment Co.
Rassieur, T. E.
Centricula & Mechanical
Inda. Inc.
\*Bigley, Parker W.
\*Bilderback, James E.
Chamber of Commerce
Kerr, John Davidson, Jr.
Euclid Sales & Service Inc.
\*Schott, W. Dean
Frazier Davis Const. Co.
Gunther, Roy J.
Hammermills Inc.
\*Oberhellman, T. A.
Hewitt-Robins Inc.
Purmort, Arthur S.
Ingersoil-Rand Co.
Austin, William E.
Joy Mfg. Co.
Bergman, George W.
Jones, Walter M.
Ludlow Saylor Wire Cloth
\*Hogan, Virgil R.
Mico Mining & Milling Co.
Bailenson, Albert
Mine Safety Appliances Co.
\*Buys, Victor W.
Minerva Oil Co.
Jones, Berkley
Desloge, Joseph
Monsanto Chemical Co.
Emigh, G. Donald
Hurst, Thomas L.
\*Yancik, Joseph J.
Nordberg Mfg. Co.
Currier, W. R. Neil
Ortrue Inc.
Weidlich, Gilbert A.
Peabody Coal Co.
Arnold, Cecil P.
Burkhardt, Fred R.
Cole, John Thomas
\*Elfred, F. Stillman
Guthrie, Cecil M.
Hagen, Hubert D.

Massmann, A. P.
McCollum, H. C.
Orlandi, William J.
Phelps, Edwin R.
Quenon, Eugene E.
Weimer, Wilbur A.
H. K. Porter Co.
Hartup, Robert Rex
St. Louis University
Blum, Victor J.

\*Carr, Jerome B.
Heinrich, Ross R.
Sverdrup & Parcel

\*Pence, Harry S.
Union Elec. Co.
Heck, Henry W.
U. S. Air Force
Finklang, John W.
Valley Dolomite Corp.
Day, Henry P.
Donnell, Ben P.
Washington University
Hinchey, Norman S.

\*Sharon, H. LeRoy

\*Tolman, Carl
Barry Wehmiller Mach. Co.

\*Brinsmade, H. S.
Self Employed

\*Neustaedter, Harold A.

\*Peugnet, Amedee A.
Other

\*Brinkmann, Anthony F.

Other \*Brinkmann, Anthony F.,

\*Brinkmann, Anthony Jr. Frank, A. J. George, Jules C. Horner, Preston K. Kwentus, Alan H. O'Brien, Earl P. Rumer, Robert R. Stifel, Carl G. Thompson, George O.

SALEM

Amer. Metal Climax, Inc.
Buder, Theodore A.
Williams, G. Kemp
Bear Creek Mining Co.
O'Brien, Daniel T.
New Jersey Zinc Co.
Kassay, Robert W.
Teet, John E.
Other Other Kisvarsanyi, Geza Larsen, Kenneth G.

SHREWSBURY

Other Benecke, R. E.

SULLIVAN

Meramec Min. Co. Bent, Douglas Wm. Bilhelmer, Earl L. Peets, Robert G. Perkins, Ralph C., Jr.

UNIVERSITY CITY

Other Neely, Percy C., Jr.

VIBURNUM

St. Joseph Lead Co.
\*Klosterman, Gregory E.

WASHINGTON

Other Swoboda, Raymond B. WEBSTER GROVES

Other

Davis, Robert I.

MONTANA

ANACONDA

ANACONDA

Anaconda Company
Barnard, Enoch A.
Chestnut, Ben H.
Dahlem, David H.
Davis, William B., Jr.
Day, Frank H.
'Diaz, Lautaro S.
Fulmor, Theodore G.
Gale, George D.
'Kettner, Raymond V.
McCrea, J. Hollis
McDonald, Bernard T.
Miller, Robert B.
Mitchell, Fergus G.
'Moore, John R.
Roeder, Fred A.
Ruckwardt, Kurt F. \*Ruckwardt, Kurt F. Stokke, Melvin A. Tri-City Concrete Prod. Div. \*Nicely, Hugh G.

Bigley, A. C.

Missouri-Montana

Bolles, John L. Fisher, Truxton J. Foard, Harold Foard, Harold Freshhour, Chester Frick, F. F. Grant, John A. Holdereed, F. L. Maguire, Hugh J. Worsdell, John J.

BILLINGS

Self Employed
\*Johnson, Clarence J. Other Albin, B. R. Larson, Alan H.

Anaconda Company
Ash, Samuel

\*Bonner, Edward O.

\*Bishop, Lester F.
Bossard, Floyd C.
Connell, James P.
Davis, Thomas K.
Dimock, Everett P.
Donner, Donald L.

\*Dogherty, John F.
Droubay, Juel G.
Du Toit, Petrus J. G.

\*Gluck, George S.

\*Greenough, Jack S.

\*Grunig, James K.

\*Guilbert, John M.
Hannifan, Martin K.
Huribbut, Stewart W.
Ingersoll, Robert G.
Jr.
Jeniker, Frank E.
Kirchner, James C.

Kolessar, John J.
Langfeldt, L. Daniel
Łukins, Thomas C.

\*McAleer, Joseph F.
McCanna, Marcus E.
Norem, William C.
Payne, William D.
Peterson, Edward M.
Piper, R. Davidson
Renouard, Edward I.
Rutledge, Peter A.
Shea, Edward P.
Skaastin, Fred J.
Staggs, William M.

\*Stewart, Richard Maclin

\*Strandberg, Fred W.
Suttie, John M.
Tierney, Edward D.

\*Wayment, Wm. Ross
Wendel, Herbert A. J.
Wratth, William, III
Zelhen, Lester G.
Archibald Co.
Archibald Co.
Archibald, James K.
Boland Develop. Co., Ltd.

\*Young, Herbert G.
Contact Mining
Antonioli, Frank M.
Gardner-Denver Co.
Rome, William A.
Hammond-Everly Engrg. Co.

\*Everly, Walter F.
Ingersoll-Rand Co.

\*Foretr, Rodney C.

\*Weisner, Robert C.
Mont, Bur, of Mines & Geol.

\*Chellini, Joe M.
Cowiter Frank A.

Mont. Bur. of Mines & Geol.

"Chelini, Joe M.

"Crowley, Frank A.

"Johns, Willis M.

"Sahinen, Uuno M.
Montana Highway
Commission
"Peyton, Sidney B.
Mont. School of Mines
Adami, Arthur E.

"Cox. Willard E.
Earil, Fred N.
"Fisk, Henry G.
"March, Walter S., Jr.
McGlashan, D. W.
"Stout, Koehler S.

"Vine, William A.
Mont. State Highway Comm.
"Matthew, Richard R.
Russken Mining Co.
"Judd, Kenneth M.
Texaco Inc.
"Hone, Robert D.
Westinghouse Electric Corp.
"Clapp, Glenn H.
Self Employed
"Griswold, George Gary, Jr.
Other

Other

her
Ahrens, Ernst H., Jr.
Bauer, Walter E.
Bookey, Jack H.
Bowsher, John A.
Brophy, James R., Jr.
Champ, Clarence A.
Driscoll, James E.
Dugdale, Raymond
Farmin, Jeremy C.

# Montana-Nevada

ontana-Nevada
Gallant, Raymond B.
Geach, Robert D.
Goddard, C. C., Jr.
Hammond, Roy H.
Jaccard, Frederick C.
Johnson, H. F.
Linforth, Frank A.
Matthews, Chas. S.
McAuliffe, D. C.
O'Brien, W. A.
Warren, John W.
Williamson, William
Wise, T. Chas.
Zipperian, Donald E.

Other Stevens, Edwin W.

COLUMBIA FALLS Anaconda Aluminum Co. Hanson, George T. Other

Dixon, Wallace J.

# COLUMBUS

Other Gaethke, F. P.

# DARBY

Cummings-Roberts Blackburn, Gordon L. \*Taber, John W.

#### DEER LODGE

Relyea Phosphate Mine Cox, William R.

# DILLON

Hand Mines
\*Hand, William M.

#### EAST HELENA

Amer. Chem. Corp. Porter, William H. Amer. Smelting & Refining Clow, Lyle F. Loughridge, K. D. Other De Santis, Peter A.

# GARRISON

Montana Phosp. Prod. Co. Bell, Leslie V. Burnet, Fred E. Hendricks, Donald A. Martin, Thomas W. McGuire, Michael D. Sweeney, Peter H.

# GREAT FALLS

The Anaconda Co.
Balhiser, Robert H.
Cadwell, Graham M.
DeArmond, Charles F. Other Villeneuve, M. J.

# HEATH

U. S. Gypsum Co. Sadar, Edward

# HELENA

Collins Land Co. Collins, Ted E.
State Board of Health
Hunt, Homer M.
Self Employed
\*Rawles, William P.
Other. Other DeLude, Chas. T. Nelson, Robert H.

# KALISPELL

Kraft, Paul

LEWISTOWN

Other Diekman, Duane

# LIBBY

Zonolite Co. \*Allen, Thomas J.

# MARYSVILLE

Montana Rainbow Mining Co. \*Wade, William R.

# MISSOULA

U. S. Forest Service MacDonald, D., III Morrison, Gary G. Other Walters, Ray E.

American Chrome Co. Adler, James E. Bley, John Harris, Dwight L.

# PHILIPSBURG

Taylor-Knapp Co. Johnson, Donald S. Trout Mining Co. \*McKinley, Chas. A. \*Radford, Norman A. Taylor, Alvin V., Jr.

# RAMSAY

Other Ripley, Paul M.

# ROUNDUP

Johnson, Walter J.

# ST. REGIS

Routon, Donald E.

# STEVENSVILLE

Other \*Evans, James R.

# ZORTMAN

Self Employed \*Lund, Robert L. Garwood, R. G.

# **NEBRASKA**

# OMAHA

Omana Allis-Chalmers Mfg. Co. Cunningham, John C. Quinn, Joseph S. Corps of Engineers Spring, Stanley G. Union Pacific Coal Co. Bayless, L. N. U. S. Army Corps of Engrs. Woodbury, William D. Other Other Marold, Frank

# RIVERTON

Other Ziegler, Jay R.

# SOUTH BEND

Western Sand & Gravel Co. Sherwood, Don H.,

# NEVADA

# BATTLE MOUNTAIN

Boot Strap Mine Fisher, Marion S.
Blaine Hoalst Co.

\*Hoalst, Blaine C.
Magnet Cove Barium Corp.
Seldin, Marvin B.

# BEOWAWE

Goldacres Mine Treweek, Harry W.

# BLUE DIAMOND

Blue Diamond Corp. Brooks, Marion C.

\*Cain, J. H.

Waldthausen, H. L., Jr.

\*Wells, Herbert C.

# BOULDER CITY

Self Employed \*Zerposs, George F. ner Dieleman, Jake W. Douglas, Edwin B. Mead, Tom C. Place, A. E. Ray, D. M.

# CARSON CITY

Dayton-Inspiration Gold Corp.
\*Wiedeman, Rob't. R.

Miller Geophy. Expl.

\*Miller, M. Douglas
State of Nevada
Dondero, Fuiro N.
Utah Constr. & Mining
Smith, Frederick L.

Larsh, Walter S.

# CRYSTAL BAY

Other Coulter, William J.

# EAST ELY

Ely Gold Mining Co. \*Walker, Wm. J. Marc-Inc.
 \*Erickson, Einar C.
Prospector Labs
 \*Berge, Byron T.

Other Coulthard, John F. Dean, Peter W. Zunino, John

Ruby Hill Mining, Co. Livermore, John S. Paroni, Walter A.

# GARRS

GABBS

Basic, Inc.

"Bishop, Jack C.
Cahill, Thomas M.
Dixon, Augustus M.
"Newman, Harold C.
Sullivan, George L.
Sutton, Raymon E.
Willard, Harrold P.
Gabbe Exploration C.
Dougan, Lee D.
Standard Slag Co.
Evasovic, Mike
Gaylord, G. B.
Jones, Robert O.
Maher, William C.
"Rohlfs, Otto D., Jr.
Wood, Archie C.

# GOLCONDA

Getchell Mine, Inc.
Chamberlain, Clair C.
Hisle, William H.
Middlebrook, John
Nojima, Tetsuo Roy
Stanford, James V.

# HENDERSON

Basic Management, Inc.

"Howard, Victor T.
Park, Edwin F.
Howe Sound Co.

"McCarroll, Sidney J.
Manganese, Inc.
Hawkins, Charles S.
Staufer Chemical

Stauffer Chemical Co.

\*Newell, Arthur T.
Titanium Metals Corp. of

Amer.

Eck, Laurence T.

Love, Frank E.

Pope, Charles R.

Rosenberg, Hary W. U. S. Lime Ellis, Wm. E.

Other Taylor, Glen C.

# KIMBERLY

Other Miller, Charles E.

# LAS VEGAS

Clary, Wilke & Assoc.

\*Clary, Ernest H.
Crane Products Mfg. Co., Inc.

\*Grizzle, J. R.
Geo.-Engineers, Inc.

\*Solomon, James
H.P.H. Mine
Hezzelwood, Lawrence L.
Leprechaun Min. & Chem.,
Inc. Inc.

\*Keegel, Charles P.

\*Pralle, Gert E.
Root Zinc Min. Co.
Fayle, Leonard R.
Wells Cargo Inc.
Wells, J. W.
Self Employed

\*Nelson, Harry E.
Other

Other
Brown, William M.
MacDonald, John C.
Scherer, O. J.

# LOVELOCK

Eagle-Picher Co. Eagle-Picher Co.

\*Spencer, Emmett L.

Min. Basin Ex. Co.

\*Bottomley, Edw. J.

Mineral Materials Co.

\*Leidich, Peter W. Other

Fitznatrick, H. R.

## MC DERMITT

Cordero Mining Co. \*Hager, Edward H.

# MC GILL

Bear Creek Mining Co.

\*Greene, Frank F.
Kennecott Copper Corp.

\*Crosser, Ralph W.
Denny, Jere R.
Kinnear, John C., Jr.
O'Shaughnessy, M. J.

\*Schultz, Francis C.
Smith, B. B.

\*Stolk, Willem F. A.
Other Other Draper, Elwin V.

# MERCURY

Reynolds Elec. & Eng. Co. Fisk, Elwin L. \*Flangas, William G. \*McGregor, Donald R.

Self Employed \*York, Bernard

# NORTH LAS VEGAS

U. S. Lime Products Cardwell, Charles H.

### OVERTON

West Coast Silica Co. \*Morledge, Fred L.

# PIOCHE

Atlanta Gold & Uranium Co.

Atlanta Gold & Uranium Co.

"Collins, Clyde E.
Bristol Mines Co.

"Hardle, Byron S.
Combined Metals Reduction Co.
Gemmill, Paul
Swanson, Henry E.
Ploche Mines Cons.
Janney, John
Self Employed
Lindblom, Raymond A.
Scott, Albert L.

Acme Auto Agency
"Anderson, A. E.
The Anaconda Co.
Jones, John Kenneth
Wilson, James R.
Cooke, Everett & Assoc.

Cooke, Everett & Assoc.

\*Cooke, Herman R., Jr.
Eagle-Picher Co.

\*Steinheimer, Milton

froom Min, Benjamin H.
Homestake Mining Co.
Parker, A. Breck
Isbell Const. Co.
Barkley, James R.
Boise, Charles L.
Laughton, George L.
Mine Services Co.

Laughton, George L.

Mine Services Co.

"Hartley, Gerald B., Jr.

Nevada Mineral Products

"Parker, James Ben.

Nevada Bureau of Mines

"Horton, Robert C.

Olson, Richard H.

"Schilling, John H.

P. & M. Enterprises, Inc.

MacKenzie, A. E.

Pioneer Title Ins. Co.

"McGuire, Philip C.

Sierra Engineering Co.

Mecham, Ferris Joseph

Siskon Corp.

Mecham, Ferris Joseph
Siskon Corp.
Chessher, Hubert Byrd, Sr.
Chessher, Hubert B., Jr.
Union Carbide Nucl. Co.
Galli, Peter E., Jr.
Morgan, James E.
Vitz, Howard E.
Wharton, Heyward M.
Bureau of Land Mgmt.
Hollingsworth, Edgar A.
U. S. Bureau of Mines
\*Engel, A. L.
Johnson, Albin C.

Long, Albert E.
Rice, Andrew C.
University of Nevada

\*Butler, John N.

\*Gianella, Vincent P.
Hammond, Claude W.

\*Payne, Anthony L.

\*Scheid, Vernon B.

\*Slemmons, David B.

\*Voskuil, Walter H.

\*Weyler, Paul A.

Self Employed
DeLongchamps, Fred J.

\*Hardy, Roy A.
Hart, James P.

\*Hill, Starr, Jr.

\*Johnston, W. P.

\*Lawrence, Edmond F.
Liddell, Parker

\*Lohse, Fred
McDonald, Joseph F.

\*O'Connor, Arthur J.

\*Ricker, Spangler

\*Riker, O, Perry

\*Silver, Albert

\*Van Voorhis, B. W., Jr.

Other
Adams, Clark N. Other

her
Adams, Clark N.
Adams, Roderick W.
Beal, Laurence H.
Carpenter, Jay A.
Gordon, Louis D.
Heizer, John M.
Isbell, C. V.
Jerome, Stanley E.
Kenney, John W., Jr
Kurtz, William L.
Lawrence, F. A.
Muth, Edmund A.
Nelson, Harve P. Mutn, Edmund A. Nelson, Harve P. Richardson, W. V. Richardson, Warren B. Smith, Alfred M. Spitzer, Robert B. Temp, Edward W.

Kennecott Copper Corp.
Bauer, Herman L., Jr.
\*Cooper, James J.
\*Hughes, Richard A.
Larsen, Reuben D.
Smith, John G.

Other McBeth, Joseph D. Muse, Rush

# SPARKS

Dubois, F. E., III Lyda, Gordon R.

# TONOPAH

Self Employed \*deCarbonel, Wm. L.

# TUNGSTEN

Nevada-Massachusetts Co. \*Caldwell, James R. Gronning, Ralph Leland Nash, Eldridge \*O'Keefe, Daniel A.

# WEED HEIGHTS

The Anaconda Co.
Burch, Henry R.
Campbell, Robert L.
Gill, Donald K.
"Goddard, Bruce B.
Gould, Allison J.
Greene, Thomas A.
Keith, Frank A., Jr.
"Millar, Albert E.
Monninger, Frank M.
Yerington Mine
Jacky, H. W.
Other Other McMahan, Jack E.

# WELLINGTON

Other Annett, Norman T.

# WINNEMUCCA

Jackson Mt. Mining Co. Austin, Wilfrid G. Self Employed \*Newman, William J. Other Baldwin, H. W. De La Mare, G. W.

# YERINGTON

The Standard Slag Co. \*Harcourt, Milo M.

Other Harmon, John R.

NEW HAMPSHIRE

CLAREMONT

Joy Mfg. Co. Cooney, Edwin W. Curtis, J. C. 'Goodrich, Ross H. Mancantelli, Robt. W. Other Smith, Duray

CONCORD

Self Employed \*Pitts, Parker D.

EXETER

Other Molloy, John S.

FRANKLIN

Other Alexander, Wm. J

HANOVER

Dartmouth College
\*Stoiber, Richard E.
U. S. Army
McAnerney, John M.

NO. HAMPTON

Other Hobby, Edgar N., Jr.

SALEM

Other \*Chase, Leonard R.

NEW JERSEY

BERKELEY HEIGHTS

Minerals & Chemicals Philipp Corp. Smith, Homer A. Other Heyman, Arthur M.

BERNARDSVILLE

Other West, Woodrow W.

BLAIRSTOWN

Other Kynor, Herbert D

BOONTON

Norda Essential Oil & Chemical Co., Inc. Amaducci, Louis

BOUND BROOK

Research-Cottrell Inc. Schork, John E. Other \*Cummins, Arthur B.

BRANCHVILLE

Willis Paul & Proctor Inc. Willis, Sherred A.

BURLINGTON

U. S. Pipe & Fdy. Co. Schuh, A. E.

CALDWELL

Fenwick Machinery Inc. Fenwick, Paul

CHATHAM

Other Evans, W. F.

CLIFTON

Magnetic Eng. & Mfg. Co. Ferris, James J.

CLINTON

Hanks, George R.

CLOSTER

The Anaconda Co.
\*Costantini, Ralph

COLONIA

Other Gallit, E. H.

CRANFORD

Other Garland, Acel

DOVER

Alan Wood Steel Co. Kertiu, John P. Meyers, Laurence V. Usinowicz, Stanley J. McKiernan-Terry Kamener, Easil A. Shahmoon Ind., Inc. Brophy, Martin J.

DENVILLE

Thiokol Chem.
\*Mock, Allen G.

E. ORANGE

Other Rodgers, A. T.

ELIZABETH

Georgia Kaolin Co. Murray, Haydn H. James Equipment, Inc. \*James, U. S., Jr. Victaulic Co. of Amer. Costanzo, Frank X. English, Richard W.

ENGLEWOOD

Self Employed
\*Burris, Michael M. Other Loveman, Michael H.

ESSEX FALLS

Other Bartholomew, George P. Sappelli, Richard J.

FAR HILLS

Queneau, Augustin L.

FLEMINGTON

Other MacFarlane, J. K.

FRANKLIN

N. J. Zinc Co. Callahan, William H. McCann, R. L. McKechnie, Donald

Other Haight, Clarence M

GLEN ROCK

Other Raffo, Edward F.

HACKENSACK

Metronic Eng. Co., Inc. Leitner, Adolph F. Other Huber, Willard L.

HARRISON

Worthington Corp Alers, Perry A

HILLSIDE

Other Kilcarr, Gilbert M.

HOBOKEN

Stevens Inst. of Tech., Davidson Lab. \*Marlowe, Sherwood V.

HOPATCONG

Other Shearer, John L.

JERSEY CITY

Leonard J. Buck Inc. Buck, Leonard J. Other Miller, Jack S.

KENILWORTH

Adamas Carbide Corp Fischer, Albert J.

LAKEHURST

Glidden Co. Miller, Elwood A.

LEONIA

Other Bohn, Charles A.

LITTLE SILVER

Other Davis, G. H.

MADISON

Shoaf, Charles D.

MAHWAH

Amer. Brake Shoe Co.

\*Avery, Howard S.
Smith, Frank W.

MANVILLE

Johns-Manville Corp.
Blair, Laurence R.
\*Kadey, Frederic L., Jr.
King, Herbert L.
Streib, William C.

MATAWAN

Other Meyjes, E. I.

MAYWOOD

Other Hook, William D.

MENLO PARK

Min. & Chem. Corp. of Amer. Greene, Ernest W.

METUCHEN

Other Kemp, L. W.

MONTCLAIR

Other Cannon, Daniel W. Graddon, F. C. Huber, Charles F. Sawyer, Geo. P.

UPPER MONTCLAIR

Other Faulkner, R. H.

MORRISTOWN

Allied Chem. Corp.
Pennington, James R.
Puttuck, Harry E.
Trepp, Wilbert J.
Houdaille Const. Mat. Inc.
\*Hagerman, Robert M.
Ringgold Coal Minig Co.
Peters, James W.
Other Other Karchmer, Nathan K.

MURRAY HILL

Air Reduction Co. McKenna, F. E. Airco Res. Lab. Koch, Eugene Other Cogswell, H. K.

NEWARK

Linde Co Linde Co.
Fleming, David H.
Rolseth, Harold C.
Lubriplate Div. Flake
Tiernan, James B.
Newark Coll. Rutgers Univ.
\*Hamilton, Charles L.

NEW BRUNSWICK

Rutgers Univ.
\*Lodding, William Other Beals, Rixford A.

NEWFIELD

Shieldalloy Corp. Clymer, W. Bruce

NORTH BERGEN

Hillburn, Fred E Wendt, Edward I

NORTH HACKENSACK

Compressor & Rock Service Corp.
Burke, Jack J.
\*Devitt, Martin E.

NO. PLAINFIELD

Other Reid, John W.

OAKLAND

Other Adkins, R. C. OGDENSBURG

Other Hastings, Warren

ORANGE

P. S. Miller & Associates
\*Miller, Philip S.

OXFORD

Alan Wood Steel Co. Fyfe, Lawrence

PARAMUS

Atlas Copco Eastern Inc. Bremner, Michael W. Goodwin, Donald J. Warren, Thomas E.

PASSAIC

PASSAIC

Hewitt-Robins Inc.
Asman, Arnold W.
Lautenschlaeger, Harold C.
\*Ritmeester, Henry J.
The Okonite Co., Sub. Kennecott Copper Corp.
Weichel, Thomas R.
Sika Chemical Corp.
Schmid, Emil
\*Sommerfeld, Theodore E.
U. S. Rubber Co.
\*Tise, William R.
Other

Other Greene, Enoch F.

PERTH AMBOY Intl. Smelt. & Ref. Co. Brady, Frank H.

PHILLIPSBURG

Ingersoll-Rand Co. Kurt, Ewald H. Paulson, Loree A. D. Wassel, Michael J. Shahmoon Industries Palombo, John C.

PLAINFIELD Other Katrausky, Joseph

PLUCKEMIN

Other Cromwell, Robert H.

POMPTON LAKES

Other Winters, A. B., Jr. PRINCETON

Princeton Univ.

\*Bonini, William E.

\*Kalliokoski, Jorma O.
Parker, Howard A.
Thom, W. T., Jr.

Other Sampson, Edward

RIDGEWOOD Self Employed \*James, Jack A. Arguedas, Arthur Corrigan, G. H.

RINGWOOD

Self Employed \*Zima, Pavel RIVER EDGE

Other Vandenberg, Jacob

RIVERTON W. W. Criswell Co., Inc. Criswell, W. W., Jr.

RIVER VALE Other Reedy, Richard W. Nevada-New Jersey

SCOTCH PLAINS

Other \*Wroth, James S.

SHREWSBURY

Other Hymer, H. G.

SOMERS POINT

Le Roi Division, Westinghouse Airbrake Davis, Daniel J.

SOMERVILLE

Other Sies, John R.

SOUTH AMBOY National Lead Co.
Alessandroni, Hugh V.
Anderson, William W., Jr.
Cole, Sandford S.
Lynd, Langtry E.

SOUTH BOUND BROOK

Other Luty-Lutenko, Alex

SOUTH ORANGE

Other Stanwick, Charles A.

SOUTH PLAINFIELD

Amer. Smelt. & Ref. Co. Haagensen, Robert B. Kranz, Paul J. Stiefken, Charles E. Vogt, Thomas L.

SPARTA

Other \*Flinn, Alfred R.

SPRINGFIELD

Other Fores, S. Lennart

SUMMIT ner Jungersen, T. G. Jungersen, T. G., Ji Marble, Earl R., Jr.

TEANECK Ledoux & Co., Inc. Ledoux, Louis Pierre Other Bryers, Wesley E.

TENAPLY Other Lilley, Ernest R.

TRENTON TRENTON

S. G. Frantz Co., Inc.

\*Frantz, Samuel Gibson

New Jersey Dept. of Conservation & Eco. Dept.

Widmer, Kemble

New Jersey Geological Survey

\*Parrillo, Daniel G.

H. K. Porter Co., Inc.

Albertson, Curtis C.

John A. Roeblings Sons

Lex, W. Irving

United Clay Mines Corp.

Guenther, Wm. F.

Hall, Clyde W.

Lee, Gordon W.

Peck, Douglas R.

Rider, William L.

Self Employed

\*Johnson, Meredith E.

UNION CITY

Shell Chemical Co.
\*Pollner, Leonard C. Self Employed Michenfelder, Frank

UPPER MONTCLAIR

Other Roebuck, John H.

VINELAND.

\*Osborn, Franklin Other \*Skinner, William V.

# New Jersey-New York

#### WESTEIFID

Self Employed Crowe, John J. \*Fraser, Oliver B. J. \*Fraset, O. Clifton S. \*Corbett, Clifton S. Foust, John H. Gruner, Frederick R. Ross, R. H. C. Wiendl, Joseph A.

#### WEST NEW YORK

Other Pellicciotto, T., Jr.

#### WEST ORANGE

The Electric Storage Battery weeks, Robert H., Jr. Other Noel, Don O.

# WHARTON

Horvath, M. J. Soussa, Maurice S.

# WHIPPANY

General Electric Co. Hauschild, Louis W.

# WOOD RIDGE

Curtiss-Wright Corp. Tillson, Benj. F., Jr.

#### NEW MEXICO

#### ALAMOGARDO

Other Brown, John Patrick

# ALBUQUERQUE

ALBUQUERQUE

American Cyanamid Co.
Hostetter, Glenn E.
Cactus Realty, Inc.
\*Ashlock, Walter T.
Chapman, Wood & Griswold
\*Griswold, Gilbert R.
\*Wood, John A.
Colo. Mines & Metals Co.
\*Chase, Edward T.
Joplin Machy.
Reynolds, Jas V.
Kaiser Gypsum Co.
Read, Myron
Lovelace Foundation
Taborelli, R. V.
Trojan Powder Co.
Christensen, E. W.
U. S. Forest Service
Tragitt, E. Rowland
University of New Mexico
\*Kelley, Vincent C.
Self Employed
\*Leland, George R.
Other
Barkley, Raymond C.

Other Barkley, Raymond C.

Barkley, Haymond Birdseye, H. S. Brown, H. G., III Devilliers, Wm. R. Dixon, Roy W. Garcia, John A. Hall, Leroy E. Hardin, M. M. Tucker, Edwin G.

# BAYARD

U. S. Smelt. Ref. & Min. Co. Glover, Gordon T. Jess, Donald A.

# CARLSBAD

Duval Sul. & Pot. Co.
Bourne, Douglas J.
Li, Hon C.
\*Taylor, Randall H.
Tong, Jerry E.
Farm Chemicals Resour. Dev Tong, Jerry E.
Farm Chemicals Resour. I
Corp.
Kindsvater, E. F.
International Minerals &
Chem. Corp.
Borskey, James W., Jr.
Dow, Wallace T.
Johnston, Charles E.
Pressnell, Clarence E.
Skinner, Edward C.
Snyder, John H.
Tippin, Robert B.
National Potash Co.
Ferguson, Thomas G.
Potash Co. of Amer.
Billings, Robert G.
Clark, Houston N.
Cummings, Joseph B.
Dabney, Robert R.

Davis, Farlow C.
Fritschy, J. Melvin
Knill, Raymond R.
Murdoch, James D.
Roth, Edward P.
Schaefer, Richard H.
Schoeld, Edmund A.
Schreiner, Paul E.
Southwest Potash Corp.
Herbert, Ira A.
MacIntyre, James M.
Mitchell, J. S.
Zandon, Victor A.
Union Industrial Corp.
O'Kelley, James C.
U. S. Borax & Chem. Corp.
Heaton, George A.
McCloskey, Lee E.
McFall, Chas. G.
McWhorter, Wm. S.
Miller, Earl H.
Pierson, Francis L.
Wright, John S.
U. S. Geol. Survey.
Hager, James W.
Seif Employed
\*Douglass, E. W.
\*Harley, George T.
\*Haworth, Russell G.
\*Weaver, Gaylord C.
Other
Allport, R. H.

\*Weaver, Gaylord C.
Other
Allport, R. H.
Baumann, William F.
Christo, Sam, Jr.
Corbin, Lawrence P.
Cramer, T. M.
Dancy, W. B.
Davis, F. O.
Fowler, Eldridge M.
Fulton, Robt. S.
Gant, Joseph E., Jr.
Gasparich, J. J.
Gordon, J. D., Jr.
Harrison, Marvin H. Gordon, J. D., Jr.
Harrison, Marvin H.
Hougland, R. W.
Kartchner, M. W.
Kertchner, M. W.
Keler, F. C., Jr.
Kern, J. V.
Magraw, John W.
McCloskey, J. W.
McConnell, Chas. M.
McGuire, Benjamin F.
McKechnie, Benjamin E.
Sparks, Norman E.

DEMING Self Employed \*Cannizzo, John Other McCray, Hugh E.

FARMINGTON \*\*San Juan Gravel Prod. Co.

\*Hargrove, Don
Utah Const. & Ming. Co.
\*Davis, John P.
Geiger, Albert F.

GALLUP Phillips Petro. Co.

\*Haller, Harry F.

Milne, Steve L. U. S. Army Coulter, Don M. Other Moe, Richard F.

# GRANTS

Ansconda Co.
Arlin, Zana Earl
Balentine, Floyd J.
Beck, Theodore R.
Ferguson, Donald R.
Glover, J. Harvey
Herndon, John F.
Kittel, Dale F.
Matthews, Dale C.
Pearson, John E.
Feterson, E. Clarence
Roberts, William J.
Veeder, Arthur K.
Zundel, Weldon P.
W. E. Ballmer Associates
Ballmer, Ward E.
Boyles Bros. Drilling Co.
Gunn, Robert H.
Calumet & Hecla, Inc.
Hays, Richard A.
Johnston, Glenn C.
Four Corners Explor. Co.
Rapaport, Irving
Hidden Splendor Min. Co.
Brown, John T.
Collins, William D.
Cronk, Robert J.
Fletcher, Marshall J., Sr.
Fletcher, Marshall J., Sr.
Fletcher, Marshall J., Jr.
Hahn, Edwin F.
Powers, Harold A.
Turberville, Derwin D.
Von Moss, Edward
Young, Austin L.
Homestake Mining
Crosby, Allen F.
Daugherty, Maxwell
De Jong, Leonard C.
\*Delicate, Donald T.

\*Derrer, Homer A.
\*Garman, Clyde N.
\*Gould, Walter R.
\*Graber, E. A.
Jones, Jack Q.
\*Madsen, Roger A.
Mehle, Raymond J.
Miller, Phillip R.
Oberg, Fred N.
Oberg, Tryde E.
Rizzi, Tolyde E.
Rizzi, Tolyde E.
Rizzi, Tolyde E.
Statele, Robert M.
Swent, Langan W.
Wesley, John R.
Kermac Nuclear Fuels Corp.
Alkhafi, F. A.
Ashby, Harve I.
Bolton, M. F.
Bradford, Charles B.
Bruce, William E.
Buttler, Wm. R.
Carlson, Donald O.
Casper, Marion
Cleveland, James E.
Hart, Thomas
Hatfield, Kenneth G.
Heldund, Thomas C.
Hill, Victor L.
Hohne, Fred C., Jr.
Link, James M.
\*Ludeman, Frank L.
Nugent, Lee
Patrick, Roger B.
Pertile, R. K.
Quinones, L. A.
Rendall, Eric S.
Sallee, Graydon L.
Stanley, Charles F.
Swales, John M.
Taylor, Burrell G.
Ward, Milton H.
Woody, Robert J.
Zambas, Peter G.
Kerr-McGee Oil Ind.

Taylor, Burrell G.
Ward, Mitton H.
Woody, Robert J.
Zambas, Peter G.
Kerr-McGee Oil Ind.
\*Loghry, James D.
\*Vizcaino, Henry
Lance Corp.
\*Ericksen, Edward W., J.
\*Jucevic, Edward W., J.
\*Jucevic, Edward W., J.
\*Ruhfus, Bernd W.
Waissar, R.
Log-Master Services, Inc.
\*Lynn, W. W.
Phillips Petr. Co.
Arnold, David C.
Berg, Lincoln J.
Drips, Robert C.
Doney, Charles E.
\*Durfee, Jay W.
Everts, Jason E.
Friberg, Morris E.
Gilg, Kurt
Greenslade, James O. Friberg, Muric Scilg, Kurt
Greenslade, James O.
Halls, William W.
Havenstrite, Stuart R.
McLaughlin, E. D., Jr.
Moulton, Wesley G.
Owen, James R.
Ruoho, Armas A.
Taylor, Paul S.
"Vandel, Jerry D.
"Vanderpool, John S.
"Wallis, Harley W.
Jateau Hardware, Inc.

Plateau Hardware, Inc. Manson, G. W. Manson, G. W.
Rare Metals Corp. of Amer.
Snider, James J.
Republic Supply Co.
\*Bannerman, Edward S.

\*Bannerman, Edward S. See Tee Mining Corp. \*Schultze, Raymond L. U. S. Atomic Energy Comm. Grutt, Eugene W., Jr. \*Holmquist, Ray J. Tipton, William D. Young, Thomas W. Self Employed Connell, Matt A. \*Melancon, Paul E. \*Ritter, Norton R. Other

\*Melancon, Paul E.
\*Ritter, Norton R.
Other
Andrus, Niles J.
Barry, L. D.
Dice, Fred R., Jr.
Dolezal, Wayne R.
Forest, Robert T.
Gebeau, Arthur E.
Gibbs, Clifton M., Jr.
Hamilton, James
Harper, Aaron V.
Honkala, Arvid E.
Keil, Howard R.
Lyons, Lamar
Maguire, James H.
Markosky, Charles E.
Mathis, Gerald C.
McAlexander, R. M.
McMillan, G. A.
Millsap, Wayne A.
Robison, Howard H.
Russell, Bruce E.
Shields, Elimer R.
Smith, Murray T.
Stern, W. R.

# HANOVER

American-Peru Min. Co.
Conley, Leslie J.
\*Faust, Jerry W.
Rodriguez, Gilbert G.
Schreiber, Hans W.
N. J. Zinc Co.
Snell, C. C.
Winslow, Kenneth R.

# HURLEY

HURLEY
Kennecott Copper Corp.
Brubaker, Joseph J.
\*Colbert, Frank A.
\*Gould, Charles H.
Graves, Henry E.
Haivala, John M.
Jacobs, B. C.
Lawrenz, Waiter R.
Lemke, Paul A.
Ligasacchi, Attilio
Miller, Howard R.
Newell, Oliver J.
\*Quay, Jack H.
Rousseau, Edwin S.
Slover, Edwin A.
Smith, David L.
Other

Esparza, Hector J Ganley, Robert D. Tipolt, Thomas E.

# LAGUNA

Anaconda Co. Gray, Donald P.
Riddell, Horace C.
\*Sieferman, Richard C.

# LAS VEGAS

Other Wilbanks, John R.

# LORDSBURG

Other Jordan, Lou D.

# LOS ALAMOS

Imprescia, Richard J.

# MILAN

Other Mahon, Scott

# PREWITT

Kermac Nuclear Fuels Corp. Kuck, David L. Other Dole, Henri E.

# RATON

Kaiser Steel Corp. Dennison, W. K., Jr. \*Morris, Lewis M.

# ROSWELL

Hicks, Charles W. Leslie, George R.

# SANTA FE

G. F. Glassmire & Assoc.

\*Glassmire, Samuel Haven
Green River Oil Co.

\*Ward, Jack B.
Klaner & Assoc.

Follock, Martin W.
New Mexico Mining Assoc.
Darmitzel, William F.
Sabre-Pinon Corp.
Craigle, Hugh M.
San Pedro Mines Group
Williams, Charles F.
Self Employed

\*Bartlett, Albert B.
Other

Other
Mann, Donald M.
Matson, J. T.
Umholtz, Willis E.

# SANTA RITA

Kennecott Copper Corp.
Adkins, William E.
Baltosser, Will W.
Brockman, James H.
Graeff, Willis S.
Herrington, E. B., Jr.
\*Kim, Young Chang
\*Knapp, Crawford E., Jr.
\*Matthews, Rex Elbert
McNaughton, David D.
Nichols, B. W.
Schaffner, Curtis R., Jr.
Shilling, Robert W.
Other

Other Wilmeth, Howard A.

#### SHIPROCK

Kerr-McGee Oil Ind., Inc. Shaw, Merle N. Stevens, Billy Winston, James M.

#### SILVER CITY

Kennecott Copper Corp.
Schmidt, Donald W.
Peru Mining Co.
Taylor, Joseph H.
Shantz & Dickson
"Shantz, Ben
Self Employed
Altman, Clyde R.
"Schmitt, Harrison A. Other
Boise, David W.
Davis, Richard R.
Spivey, Rupert B.
Word, W. G., Jr.

# SOCORRO

Dotson Minerals Corp.
\*Dotson, Carl E.
New Mexico Bureau of Mines
\*Bhappu, Roshan B.
Griswold, George B.
New Mexico Inst. of Min. & Tech.
Bertholf, William E., II
Bowdish, Frank W.
Butler, Patrick, Jr.
Deatherage, James M.
\*Latvala, Woodrow J.
New Mexico School of Mines
Long, W. W.
Self Employed
\*Anderson, Eugene C.
\*Edelen, Alexander W.
Walter, Adolph S.
Other Tech Walter, Pack Other Gill, Jack G. Gross, Gerardo W. Tuason, Clarence C Zwicky, Everitt E.

#### VANADIUM

Strong & Harris, Inc. Strong, Earl Other Cudney, G. E.

# NEW YORK

# AKRON

Other Shanley, James H.

# ALBANY

N. Y. State Museum & Sci-Isachsen, Y. William Broughton, John G.

# ALFRED

State Univ. of N. Y. College \*Brownell, Wayne E.

# AMAWALK

Sherwin F. Kelly Geophys. Ser., Inc. \*Kelly, Sherwin F.

# AMSTERDAM

Other Zwolak, John J.

# ARDSLEY

Other Jicha, Henry L., Jr.

# ASTORIA

Dodge, Basilios Trueworthy, E. B., Jr

# BARYLON

I. Y. State Dept. of Public Works \*Rose, Newton

# BALDWIN

Other Robertson, Thos. J.

# BALMAT

St. Joseph Lead Co. Dill, David B., Jr. Henry, Ralph L. Jones, Marshall G. LaPrairie, Jules P.

Lowry, Malcolm V. Reilly, John G., Jr. Riley, Mark E. Wade, Delbert M., Jr.

BAYSIDE

Other Kelley, Charles W., Jr. Nelson, Francis J.

BIG FLATS

Latta Brook Corp. Weigand, Glenn R.

BINGHAMTON

Other Von Kanicky, L. M.

BRONXVILLE

Other Klugescheid, R. C. Lundy, W. T.

BROOKLYN

Bd. of Education

\*Meyers, Marvin E.

Brooklyn College
Shimer, John A.

National Lead Co.
Orsino, Joseph Anthony
R. N. Corporation
Reed, George G., Jr.

Self Employed
Meyers, Bernard M.

\*Nagel, Theodore

Other ner
Churgin, James
Churgin, James
Fischer, Jerome D.
Fox, John H.
Graveson, D. H., Jr.
Greenwald, Morris
Howe, Harold
Jablom, Irving
Petrinovic, Alex
Snigal Joseph J

BUFFALO

Derrick Mfg. Co.
Derrick, H. William, Jr.
Hewitt-Robins Inc.
"Hickey, Merrill H.
"Rivette, Gerarde B.
Houdaille Ind.
Hankin, Montagu, Jr.
National Gypsum Co.
Campbell, Charles Oliver McGee, Leamon G.
\*Sturgess, Robt. H.
Univ. of Buffalo
Doerr, John P., Jr.

Spigai, Joseph J. Uribe-Echebarria, L.

CALEDONIA

The Ruberoid Co. Stewart, John K.

CAMBRIA HEIGHTS

Other Lloyd, Roger D.

CANTON

Other \*Brown, Severn P.

CLARENCE

Universal Atlas Cement (Div. of U. S. Steel Corp.) Chaffee, John A.

CORNING

Corning Glass Works Klein, Martin, Jr.

THE MAR

Other Crain, Leslie J.

DOUGLASTON Thompson, L. S.

EAST MEADOW

East Meadow School \*Strassberg, Morton D.

EAST MORICHES

Other Sample, Mat ELMHURST

Other Nouza, Roger

FLUSHING

Bertram, John C. Brinker, Arthur C.

CENTRYA

Other Gambrell, F. L., Jr. Williams, Geo. B.

GLENDALE

Rochester Iron & Metal Co.
\*Brownstein, Leonard

GLEN COVE

Wah Chang Corp. Baker, Robert E.

GOUVERNEUR

Gouverneur Talc Co., Inc.
Adam, Howard W.
\*Erdman, George E.
McClellan, Robert S.
Smith, Robert Langland
Internat'l Talc Co.
Dievendorf, Charles F.
Kuehl, Frederick G. Other Crawford, David J.

GRAND ISLAND

Carpenter, R. D. Morrisson, Thos. E.

HAMPTON BAYS

Byrne-Dolliver Assoc.
\*Dolliver, Charles M., Jr.

HARTSDALE

Self Employed Merrill, Pomeroy C. Other atkinson, John R. McNeal, William H.

HASTINGS-ON-HUDSON

Anaconda Wire & Cable Co. Vincent, James L.

HAVERSTRAW

N. Y. Trap Rock Corp. Foster, John C.

HEMPSTEAD

Other Reese, L. V.

HICKSVILLE

W. Lauman & Co., Inc. \*Kreitman, Abe

U. S. Steel Corp., U. A. Div. Mayne, Richard D.

HUNTINGTON

Lehren, Robert J. Schorle, Herman J.

ITHACA

Cornell Univ.

\*Anderson, Alfred L.

\*Gregg, James L.

JACKSON HEIGHTS

Self Employed
Pfoutz, Charles Y. Other Daniec, Stefan J. Krellenstein, L.

JAMAICA

Other Alexandrov, E. A.

JAMESTOWN

Weaver Matl. Service Weaver, Don S. Weaver, Fred L.

KEESEVILLE

Northern Minerals Inc. \*Burnham, Koert D.

KEW GARDENS

Other Steinberg, A. L.

LARCHMONT

Other Andersen, A. Brix Elkan, Benno

LITTLE NECK

Self Employed \*Wolf, Harry J.

LOCKPORT

Other Potts, Allen Dewey

L. I. CITY

Other Phin, Robert P.

LYNBROOK

Hubbell, A. H.

LYON MOUNTAIN

Republic Steel Corp. Crusberg, Waiter G. Knox, Edwin R., Jr. \*Phillips, John W.

MAMARONECK

American Metal Climax, Inc. Coolbaugh, Frank Other Chisholm, David B.

MANHASSET

Lee, P. G. Feely, James L.

MASSAPEQUA

Other \*Smith, Warren S.

MASSENA

Reynolds Metals Peterson, Roy E.

MINEOLA

Ducon Co.
Barfus, Joseph N.
\*Lehren, Robert J.

MINEUILLE

Republic Steel Corp. Farrell, Patrick F.

MONSEY

Other De Chetelat, Enzo

MONTROSE

cked Iron Corp. Imperato, L. George

MORICHES

Other Foote, F. W.

MT. VERNON

Philips Elec. Inst. Jones, Jack A.

NATURAL BRIDGE

Carbola Chem. Co. \*Beggs, Franklyn L.

NEWBURGH

Techmanix Corp. Nault, W. J.

NEW HARTFORD Tucker, Mana L.

NEW ROCHELLE

Ayer, Charles F. Kivert, J. A.

NEWTON FALLS

Newton Falls Paper Mill, Inc. Ross, Alex M.

NEW YORK CITY

ATME AIME
Beall, J. V.
Fox, John Cameron
Kirkendall, Ernest
Merritt, Paul C.
Tone, Donald R.
Amer. Cyanamid
Tibbals, Donald C.

\*Wintringham, Neil A. Allen-Sherman-Hoff Pump \*McTague, Walter J. Middlekauff, Robert J.

Middlekauff, Robert J
Allied Chemical
Hall, Donald A.
Sullivan, Edward G.
Allis-Chalmers Mfg. Co.
Cox, Irving K.
Geisser, Kenneth W.
Aluminium Ltd., Inc.
Echols, H. Vance
Amer. Brake Shoe Co.
Osborn, Clyde B.
American Cyanamid Co.
Behre, Merrill C.
Collinge, Barton M. Behre, Merrill C.
Collinge, Barton M.
Frith, Charles W.
Hladky, Emil
Kennedy, James S.
Amer. Elec. Power Service

Amer. Elec. Power Service Corp.

\*Eckhardt, Erwin F.

American Embassy Corry, Andrew V.

Amer. Inst. Industrial Engrs.

Lange, Esworthy P.

Amer. Metal Climax, Inc.

Aall, Christian H.

Ackerman, David H.

\*Bunker, Arthur H.

Carnahan, J. Douglass Chandler, John W.

Cowan, Lester A.

Curzon, John J.

De Neutville, Hugo Cowan, Lester A.
Curzon, John J.
De Neutville, Hugo
Haley, Dennis F.
Hochschild, H. K.
Hochschild, Walter
Howbert, John C.
Jure, Roy
Langey, Edward J.
MacLetchle, John G.
Payne, John, Jr.
Rose, Ernest T.
Sargent, Robert E.
Stewart, Fred H.
Symonds, I. M.
Towle, Charles C.
Wolff, Richard E.
American Metal Market
Lutjen, George P.
Amer. Overseas Pet., Ltd.
Douglas, Rugh
Amer. Potash & Chem. Corp.
Kremers, Howard E.
American He-Insurance Co.
Bayles, George E.
American Smelting & Refin.
Co.
Brown, Adin A.

Co. Brown, Adin A.

Co.

Brown, Adin A.

Cameron, Frank
Jourdan, Ralph L.
Kirkpatrick, Roger K.
Lord, John F.
Mann, Victor I.
McGeorge, Robert M.
Nelson, Clarence E.
Pearcey, John G.
Pollock, C. P.
Pope, Darwin J.
Strauss, Simon D.
Vaughan, R. Worth
Wolfe, A. Royce
Amer. Treat Co.
Greene, Charles T.
The Anaconda Co.
Brinckerhoff, Charles M.
Campbell, Thomas A.
Cooney, Richard L.
Coulam, John R.
Dwyer, Robert E.
Hoffman, John M.
McGlone, Edward S.
Nelson, David R.
Newin, Richard S.
Norton, John E.
Parkinson, Charles Jay
Perry, Vincent D.
Quigley, William E.
Sales, Reno H.
Schneider, Raiph E.
Swayne, William H.
Trask, Frank, Jr.
Traversone, Frank J.
Weed, Clyde E.
Wraith, Wm., Jr.
Anaconda-Jurden Assoc., Inc
Carpenter, Stewart
'Gadkowski, Walter I.

Carpenter, Stewart
\*Gadkowski, Walter I.

New York-New York

Kuralt, Richard Manter Manning, J. P., Jr. O'Rourke, John T. Otto, Arthur L. Anaconda Wire & Cable Co. Peck, C. B., Jr.

\*Strouth, Howard S.
Amer. Museum of Natl. His-\*Pitschi, Arthur T.

Best, John E.
Coleman, William R., Jr.
Craig, Coigate, Jr.
Graham, Oliver B., Jr.
Goudarzi, Gus H.
Hartung, Ludwig F., Jr.
Lane, J. F.
Lewis, Richard W., Jr.
Mark, David L.
Mills, Charles S., Jr.
Mittendorf, C. O.
Purdy, Gregory P. Mittendorf, C. O.
Purdy, Gregory P.
Reeves, Robert G.
Singewald, O. D.
Weigle, David J.
Wendel, Clarence A.
Yomtov, Joseph

Arizona Chem. Co.
Kirkland, C. J., Jr.
Geo. S. Armstrong & Co., Inc.
\*Armstrong, George S.

Asea Electric Inc.
Zetterberg, Stig
Assoc. Metals & Min. Corp.
\*Antonides, Lloyd E.
Schweitzer, H. C.

Schweitzer, H. C.
Assoc. Mine Services, Inc.
Pirtle, J. J., Jr.
Atomic Ind. Forum
Sherman, John T.
The Babcock & Wilcox Co.
Williams, Lloyd
Baker, Weeks & Co.
Fiske, Rodney G.
Barstow & Mulligan
Antonova, Helen A.
G. M. Bagford Co.
Nielsen, Henning
Behre Dolbear Co.

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Behre Dolbear Co.
Amontree, Burton
Banfield, Armine F.
\*Clarke, Vinton H.
Counselman, Theodore B.
\*Dolbear, Samuel H.
\*Donald, Douglas D.
\*Hodges, Parke A.
\*Madison, Frank H.
Benson Iron Ore Corp.
\*Myners, Thomas F.
Berwind White Coal Mining Co.

Co. Smith, Charles S. Bd. of Ed.

Smith, Charles S.
Bd. of Ed.
Alper, Harold N.
Bowring & Co.
Bowring, Charles W., III
Brandies, Goldschmidt & Co.
Wehncke, John
Richard J. Buck & Co.
Olmsted, Joseph N.
Bucyrus-Erie Co.
Norton, J. V. S.
Buell Engrg. Co.
Norvig. Otto V.
Pascual, S. J.
Vandenhoeck, Paul J.
Callahan Min. Corp.
Hall, Joseph T.
Calumet & Hecla Cons. Cop.
Lynch, W. W.
Canadian Javelin Ltd.
\*Knowles, David M.
MacPherson. William A.
\*Roxburgh, Wm. H.
Carey, Baxter & Kennedy
Goddard, Paul
Central West Coal Co.
\*Brunjes, Henry L.
Cerro De Pasco Corp.
Asher. Roderick R.

\*Brunjes, Henry L.
Cerro De Pasco Corp.
Asher, Roderick R.
De Munitiz, Arthur L.
Engelhardt, Allen H.
Feketie, John J.
Fischer, Francois A.
Goodwin, Richard F.
Haptonstall, Jack C.
Keith, Stanton B.
Kellogg, John L.
Koenig, Robert P.
Littlefield, M. B.
Lizarraga, Luis H.
McGowan, Joseph F.
Reynolds, Robert R.
Russell, Frank F.
Sharp, John F.
Sharp, John F.
Sharr, H. Danforth
Strong, Earle A.

Strong, Earle A. Vose, Gardner W. Walker, Giles E. White, John B., Jr.

# New York-New York

The Chase Manhattan Bank
Kruger, George E.
Chatham Chem. Corp.
Shea, Vincent H.
Chicago Pneumatic Tool Co.
Doner, George B.
Chile Exploration Co.
Koepel, Norbert F.
Rood, Alfred D.
Seibert, Percy A.
Cle Aramayo Des Mines of
Boilvia
"Kemper, Claude L.
The City College of N. Y.
"O'Connell, Daniel T.
Climax Molybdenum Co.
"Deltz, Louis S., Jr.
Coal Age Magazine
Davis, Harold
Given, Ivan A.
Colo. Fuel & Iron Corp.
Alter, Melvin L.
Columbia Univ.
Aldrich, Henry R.
"Arbiter, Nathaniel
"Behre, Chas. H., Jr.
Berman, Byrd L.
"Boshkov, Stefan
Fedukowicz, Waclaw S.
"Hassalis, M. D.
"Holmes, Raiph J.
Kerr, Paul F.
"Sheinkin, Moshe
"Wane, Malcolm T.
Williams, E. K. E.
Continental Ins. Co.
Heinbecker, Edward G.
Continental Ore Corp.
Lipton, Louis J.
Copper Frod. Devel. Assoc.
Moore, Charles H.
Copper Range Co.
"Jenkins, Warren J.
Coronado Corp.
"Lieb, Solomon S.
Crucible Steel Co.
"Jenkins, Warren J.
Coronado Corp.
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Crucible Steel Co.
"Jenkins, Warren J.
Coronado Corp.
"Lieb, Solomon S.
Crucible Steel Co.
"Jenkins, Warren J.
Coronado Corp.
"Lieb, Solomon S.
Crucible Steel Co.
"Persons, Robert W.
Cyanamid International
Brown, Howard L.
Bloecher, F. Wm., Jr.
De Vegh & Co.
Labe, P. Peter
Diamond Tool Res. Co., Inc.
Gold, Joseph
E. I. du Pont de Nemours Co.
Hauser, Maximillan E.
St. Peter, Albert L.
Ebasco Services, Inc.
Friend, Walter F.
Emmo Corp.
"Ross, Neil L.
"Seakwod, Herbert J.
Ullmann, Thaddeus S.
Engineered Materials
"Gitter, A. J.
Engineers Joint Council
Wheelock, L. K.
Engr. & Min. Journal
Ego, Daniel P.
Knoerr, Alvin W.
McAneny, Colin C.
Ethyl Corp.
"Anderson, E. R.
The First Natl. City Bank of

N. Y.
Creamer, Thomas F.
Miller, W. Howard
Fleischman, Burd & Co., Inc.
'Fleischman, Herbert
Flintkote Co.
Mein, Wm. Wallace
Food Machinery Chemical Corp.
Dean, Robert R.
Weygandt, Arthur S.
Work, Josiah

Work, Josiah
Ford, Bacon & Davis, Inc.
\*Raymond, Louis C.
\*Strongin, Oscar
Fordham Univ.
Lynch, John Joseph

Fortune Magazine Solcw, Herbert

Freeport Sulphur Co.
Bowenkamp, John E.
Colligan, Richard V.
Hills, Robert C.
Main, Orrin H.
Pierson, Henry L. Sampson, Charles M.
Sampson, Charles M.
Thaete, Edward H., Jr.
Wilson, Forbes
Gardner-Denver Co.
\*Martinez, Evaristo
Morgan, Ross H.

Morgan, Ross H.
General Electric Co.
Mead, George G., Jr.
The Gold Fields American
Dev. Co., Ltd.
Allen, Victor C.
Bongard, Victor
Playter, Robert F.

W. R. Grace & Co. Becker-Fluegel, H. A.

\*Perlwitz, Charles O.
\*Thomas, Josiah Ch.
H. Green & Co.
Green, Michael E.
Guggenheim Brothers

Hart, Lyman H.

\*McMillan, Donald T.
Straus, Oscar S.
Hardinge Co., Inc.
Withington, William H.

Withington, William H.
Harmon Lichtenstein & Co.
"Harmon, Robert B.
Philip J. Healey, Inc.
"Healy, Philip E.
Hercules Fowder Co.
Botsford, Robert B.
"McMorris, Armstrong C.
Pritchard, Roland W.
Sibley, A. H.
Hewitt-Robins, Inc.
"Fallon, Edward H., Jr.
Ross, Hamilton M.
"Vander Laan, Martin
Van Kleunen, Jack P.
Hornblower & Weeks

Van Kleunen, Jack P.
Hornblower & Weeks
Rudd, Alfred S.
Howe Sound Co.
\*Banks, Harold P.
Gates, Ellis H.
McGonigle, Frederick A.
Weaver, Wm. M., Jr.
Hudson Bay Mng. & Sm. Co.,
Ltd.

Green, Waldron A. **Hunting Geophysical Services** Inc.
\*Stebbins, Robert H.

Inc.

\*Stebbins, Robert H.

Hydrometals, Inc.
Hayden, William M.
Ingersoil-Rand Co.
Adamson, Robt. W.
Aldridge, Walter V.
Barnett, Milton J.
Brennan, James T.

\*Childs, Kenneth P.
Conkey, Henry G.
Doubleday, G. Chester
Dye, James A.
Foster, Ralph K.
Garriga, Jose R.
Hayes, Robert E.
Lawson, Robert W.
MacFarland, Roy G.

\*McCormack, M. L.
Fiper, Derrell D.

\*Richards, William G.
Rontz, Dietrich H.
Thomassen, Mark W.
Williams, Edwin S.
Wright, Morgan Harvey
Inspiration Cons. Copper Co.
Jacob, H. Myles
Intl. Minerals & Metals Corp.
Cassara, Louis A.
Gervais, Arthur J.
Model, Woife F.
Intl. Nickel Co., Inc.
\*Deller, Anthony William

Model, Wolfe F.
Intl. Nickel Co., Inc.
\*Deller, Anthony William
Gordon, J. R.
\*Lee, Gerald L.
\*Monell, Theodore
Sparr, William H.
Wingate, Henry S.
Intl. Ore & Fertilizer Corp.
\*Ten Eyck, Hugh Skiliman
Jamaica Test Boring Inc.
\*Fishbein, Herbert J.
A. Johnson & Co., Inc.
Johnson, A. A.
Johnson Coal & Coke Co.

Johnstown Coal & Coke Co. Crichton, G. T.

Joy Mfg. Co.

\*Bywaletz, Alfred
Evans, Joseph G.
Lane, Benjamin P.
Miller, C. W.
Williams, Philip M.

M. W. Kellogg Co.
Matson, P. W.
Mundaca, Ciro T.
\*Swart, John A.
Willis, John A., Jr.

Willis, John A., Jr.
Kennecott Copper Corp.
Brackin, Robert B.
Burgess, Charles H.
Cox, Charles H.
Feiss, Julian W.
Goodrich, Wm. H.
Jessup, Paul B.
Milliken, Frank R.
Moon, Lowell B.
Russell, Gordon B.
Simpson, James R.
Kennedy-Van Saun M.

Simpson, James R.
Kennedy-Van Saun Mig. &
Engrg. Corp.
Shafer, Maurice
Alan Kissock & Co.
\*Kissock, Alan
Cyrus J. Lawrence & Sons
Dudley, James C. Lazard, Freres & Co.
\*Forsch, Frederick D.

Lead Ind. Assn.
Ziegfeld, Robert L.
Leggette, Brashears & Graham
"Graham, Jack B.

Lehman Bros.
Lindley, Adelbert H., Jr.
Schultz, Harry C.
Leytess Metal & Chemical Corp.

Leytess Metal & Chemic Corp.
Leytess, Eugene
Link-Belt Co.
Ulrich, George H., Jr.
Lithium Corp. of America
Clarke, Fremont F.
Lone Star Cement Corp.
Van Zandt, Clalborne C.
E. J. Longyear Co.
"Merritt, Phillip Leonidas
Lord & Abbett & Co.
Wolff, Theodore F.
Lybrand, Ross Bros.
Leighton, John
Malcolm Pirnie Engrs.
Pirnie, Malcolm
MacLean, Mansell L.
Johns-Manyille Corp.

MacLean, Mansell L.
Johns-Manville Corp.

\*Jessen, H. C.
Marion Power Shovel Co.
Roberts, A. E., Jr.
McCrossin & Co.

\*McCrossin & Co.

\*McCrossin, Edward F.
McGraw-Hill Pub. Co.

\*Chellson, Harry C.
Merrill, Lynch, Pierce, Fenner & Smith, Inc.
Forrester, Wm. A., Jr.
Mesabi Iron Co.

\*Warriner, Lendall P.
Metal Traders, Inc.

\*Warriner, Lendail P.
Metal Traders, Inc.
Friedlander, Kurt A.
Miles Metal Corp.
\*Levenson, Milton
A. H. Miller Inc.
Miller, Arnold H.

Milier, Arnoid H.
Min. & Indus. Dev. Co.
Dupret, Louis E.
Minerals Search & Surveys
"Heyl, George R.
Minerec Corp.
Fischer, Arthur H.

Mobil Internati. Oil Co. Dismukes, Newton B. Montgomery, Scott & Co. Eddins, George E. W. S. Moore Co. Simon, Robert E.

W. S. Moore E.

Simon, Robert E.

Morning Star-Paisley, Inc.
Caldwell, A. Blake

Morrison-Knudsen Co.

"Phinney, E. Donald

Wm. H. Muller & Co.
Perkins, Enoch

Natl. Carbon Co.
Pitt, William G.

National Lead Co.
Holland, John S.
Holmes, W. Church

"Jacobs, Charles W. F.

Martino, Jos. A.
Reid, Jos. H.

Reiser, Allan R.

"Stewart, Alex

Stranad, Joseph

Wiles, Gloyd M.

New Jersey Zinc Co.

Wiles, Gloyd M.
New Jersey Zinc Co.
Goodwin, Sidney S.
Hutchings, William S.
Johnson, Lindsay F.
Kenly, Robert G.
Kyhkynen, Pentil W.
Ostgren, Gottfrid L.
Peirce, Willis McG.
Pettijohn, W. T.

Petrice, white McCs.
Pettijohn, W. T.
Newmont Mining Corp.
Banghart, M. D.
Benedict, Platt C.
Fulton, Robert B.
Grunow, John E.
Malozemoff, Plato
Mann, J. R. C.
McQuiston, Frank W., Jr.
Richards, Wm. F., Jr.
Richards, Wm. F., Jr.
Scheck, Friedrich A.
Schellinger, A. K.
Schmid, Walter P.
Searls, Fred
Searls, Fred
Searls, Robert J.
Smith, H. DeWitt
Smith, William T.
Tucker, Eugene H.
Volkman, Henry W.
Warren, Norman F.
Wetherell, Clyde E.
N. Y. & Honduras Rosarlo

N. Y. & Honduras Rosario

\*Altshuler, H. I.
Anderson, Homer S.
Reininger, Robert M.

N. Y. Univ.
Tilson, Seymour
Neyrpic Inc.
Chapus, Edmond E.

Nordberg, Mig. Co.
Dow, Herbert W., Jr.
Northeastern Coal Bureau
McCarthy, Edmund
O'Donnell, & Schmidt
'O'Donnell, Neil A.
Olin-Mathieson Chem. Corp.
Bennett, Malcolm G.
Zilbersher, William M.
The Ore & Chem. Corp.
Cayard, Paul C.
Schreiber, Fred
Oaborn & Tuwiner
'Osborn, William H.
Pacific Tin Cons. Corp.
Miller, F. Stuart
'Pate, Paul S.
Paine, Webber, Jackson &
Curtis
Bailey, Carroll C.
Patino Mines & Enterprises

Patino Mines & Enterprises
\*Deringer, DeWitt C.
Fajardo, Eduardo R.
Peerless Precision Prod. Co.
\*Morgan, David E.
Pennie, Edmonds
Laist, James W.

Laist, James W.
Penn. Glass Sand Corp.
Reynolds, George I., Jr.
Phelps Dodge Corp.
Dodge, Cleveland E.
Hawkins, J. Mills
Hope, John
\*Kuzell, Charles R.
Masten, John E.
Munroe, George B.
Page, Robert G.
Rea, James C.
Stuart, Herbert Z.
Winship, Charles H.
Pittston Clinchfield Coal Sales
Corp.

Pittston Clinchfield Coal Sal Corp.

\*Campbell, Robert W.
Poirier & McLane Corp.
Christy, Harold J.
Pogson Peloubet & Co.
\*Peloubet, Maurice E.
\*Smith, Bruce F.
Primary Metal & Min. Corp.
Linz, Paul
Ramseyer & Miller
\*Kienzle, Fred
Raymond, Inter. Inc.

Raymond, Inter. Inc.

\*Vermilya, Floyd D.

Revere Copper & Brass Inc.
Collins, John J.

Revere Copper & Brass Inc.
Collins, John J.
Jesse M. Robinson, CPCU
\*Robinson, Jesse M.
Roger Smith Hotels Corp.
deLima, Oscar A.
Royal Mining Co., Inc.
\*Labounsky, Alex N.
St. Joseph Lead Co.
Brigden, George I.
Cameron, Francis
Chapin, C. Merrill
Colvin, James G.
Cornell, Irwin H.
Donald, Norman H., Jr.
Fletcher, Andrew
\*Mechin, R. J.
Ramsey, Robert H.
Riggs, Lawrason, III
Samin Corp.
Hochschild, Mauricio
M. A. Schapiro & Co., Inc.
Schapiro, Morris A.
Schneider Corp.
\*Lambur, Charles H.
Scudder, Stevens & Clark
\*Eakland, Edward H., Jr.
Semet Solvay Div., Allied
Chem.
Separations Eng. Corp.

Semet Solvay Div., Chem.
Chem.
Separations Eng. Corp.
\*Jarman, G. Wallace
Ratiliff, Raiph H.
Schmidt, Lawrence D.
Shattuck Denn Min. Corp.
Bardon, Thomas
LaMond, Norman E.
Pierce, Jack C.
Shell Oll Co.

Pierce, Jack C.
Shell Oil Co.
Woodward, Warren M.
Shelter Rock Devel. Corp.
Baragwanath, John G.
Singmaster & Breyer
Brunner, John J.
\*Chelminski, Roman
\*Russell, John C.
Singstad & Ballile
\*Singstad, Ole
Skidmore, Owings & Merrill
Smith, John C.
F. L. Smidth & Co.

F. L. Smidth & Co. Deleuran, Henry Ellis, Charles B. \*Petersen, Louis
Thyrre, S. G.
F. S. Smithers & Co.
Macurda, Donald B.
Socony-Mobil Oil Co.

Hazen, George H.

So. American Gold & Plat. Co.
Breeding, William H.
O'Neill, Patrick H.
So. Amer. Minerals & Mose.
Vance. Charles A.
Spencer, White & Prentis
Prentis, Edmund A.
C. H. Sprague & Son Co.
Sprague & Henwood Intl.
Corp.
Maertzweller, Paul
Standard Ore & Alloys Corp.
Kaplan, Stuart R.
Stein, Hall & Co., Inc.
Levine, Nathan M.
Stokes Properties
Stokes, William E. D., Jr.
Stone & Webster Serv.
\*Merrill, Eugene S.
Storakopparberg Corp.
Dornsjo, T. Olof
Stricker & Henning Res.
Assoc.
\*Stricker, Adam K. Jr.

Assoc.
\*Stricker, Adam K., Jr.

\*Stricker, Adam K., Jr.
Tata Inc.
Warren, Edwin T.
Technical Equip. Corp.
\*Jacobson, M.
C. Tennant Sons & Co.
Cutler, Ralph H. Jr.,
Halton, H. W.
McIntosh, Frederick R.
\*Norem, Gordon L.

Tenn. Corp.
Ffolliott, John H.
Westlake, Emory H.
Texaco, Inc.
Zinni, N. P.

Zinni, N. P.
Texas Gulf Suiphur Co.
Donohoo, H. V. W.
Eddy, Emerson W.
Fogarty, Charles F.
Meagher, Edward C.
Wollison, Richard D.
Wright, Hugh
Titanium Metals Corp.
\*Kane, Robert L.
W. H. Texatural Co. In.

\*Kane, Robert L.

M. H. Treadwell Co., Inc.

\*Casey, Elmer L.

\*Levey, Horace B.

\*Ryan, Rhys E.

\*Tocher, Frank L.

Willis, Burton M.

Willis, Burton M.
Trout Mining Co.
\*Lambly, Charles A. R.
Tungsten Min. Corp.
\*Sweet, James R.
Tuthill & Co., Inc.
Tuthill, Marshall W.

Tuthill, Marshall W.
Unified Holidays, Inc.
Kenna, R. K.
Union Carbide Nuclear Co.
Bliss, Lyman A.
Calaman, Joseph J.
Craig, Eric J.
Cromer, Sylvan
Lentz, Kendrick W.
Lundquist, A. Q.
Mahoney, Robert M.
Van Zante, Roy D.
Union Carbide Ore Co.

Manoney, Robert M.
Van Zante, Roy D.
Union Carbide Ore Co.
Brown, William K.
Buller, Arthur E.
Frasche. Dean F.
Heuck, Arthur W.
Mee, Virginia A.
Nicholson, Hugh P.
Pullen, Leslie W.
Rove, Olaf N.
Shanklin, Fred L.
Shekarchi, Ebraham
Shoemaker, Robert S.
Spedden, H. Rush
Warde, John M.
Weiss, Edwin M.
United Nations
\*Arce, Roberto
Uris Brothers

Uris Brothers Hays, Thomas M.

U. S. Army Walker, Byron G. U.S. Navy
Garrison, Charles H.
Perkins, Grover S.,
Prickett, Gordon O.

Prickett, Gordon O.
U.S.O.M. to Iran
Wright, Wilford S.
U. S. Steel Corp., VAC Div.
Funderburg, Louis M.
Horen, Arthur
MacKenzie, James Tucker
\*Mehrhoff, William R.
Rugen, Chester D.
Tresouthick, Stewart W.
U.S. Treasury Dept.
\*Dobson, Chris G.
Wojy, Conrad A.
Victaulic Co. America
Horlick, Alex
Vitro Chemical Co.

Vitro Chemical Co. Hall, W. B.

Vitro Engrg. Co.
Checkley, David M.
Vitro Mineral Co.
Hotchiciss, Eugene B.
Louis Watsen Inc.
"Orchard, Carlos A.
Webster Mig. Inc.
Di Clement, Roland V.
Wells Cargo Inc.
Osman, Erfogroul
Wester K. Factor Found.

Osman, Ertogroul
Western Knapp Engrg. Co.
\*Frohling, Edward S.
\*Lassiter, Richard T.
J. G. White Engr. Corp.
\*Atkins, William R.
Whitehead Bros. Co.
Maddison, Robert J.

Maddison, Robert J.
Whitney & Kemmerer
Kemmerer, Mahlon S.
A. R. Wilfley & Sons Inc.
Bonardi, Bruce B.

A. R. Wilfiey & Sons Inc.
Bonardi, Bruce B.
Self Employed

\*Ayer, Frank A.

\*Bowers, Carlos G.
Easley Geo, A.

\*Freakes, Archibald W. T.

\*Gluck, Samuel E.

\*Ho, Chee-Kin
Hoffman, Robert D.

\*Moulton, Herbert G.

\*Notman, Arthur
Prochazka, George A., Jr.

\*Rudolph, William E.

\*Singmaster, Jas. A.
Thomas, Weston

\*Tower, George W.

\*Turner, Scott
Wilson, Philip D.

Wysor, Davidson C.

\*Zavorto, Basil B.

Other

"Zavofto, Basii B.
Other
Allen, Charles, Jr.
Atwater, R. M., Jr.
Austin, Albert M.
Bancroft, Howland
Bell, Gordon K., Jr.
Bereslavsky, E. V.
Bernard, Clinton
Blonsky, George B.
Bonardi, Jack P.
Brassert, Herman A.
Bryan, Russell R., Jr.
Chilcote, Julian P.
Dunbar, Douglas M.
Finel, Raymond F.
Grant, Lester E.
Grant, Lester E.
Grant, Wheadon
Guggenheim, Harry F Finel, Haymona F.
Grant, Lester E.
Grant, Wheadon M.
Guggenheim, Harry F.
Guthrie, Richard
Heiko, Bernard
Hirshhorn, Jos H.
Hoffman, Arnold
Hoguet, Joseph P.
Holloway, Edward
Hoover, Herbert
Hudson, Percy K.
Isbell, W. T.
Jeffrey, Fred R.
Laist, Frederick
Lawson, A. W.
Lindquist, Charles E.
Lindaley, Thayer
Matheson, Kenneth H.
Melitzer, Samuel
Mctalfe, June M.
Moreno, D.
Nelson, Fred M.
Neu, Hugo
Newhouse, E. L., III
Norrie, Lanfear B.
Ochs, Felix
Railing, Lewis I.
Ryd, Erik
Saltzman, David
Schider, Rudolphe
Schmidt, Bill W.
Searls, Carroll
Sharp, Ernest H.
Sheffield, John R.
Slepitis, Justin F.
Smirnow, Leonid
Stott, Gordon D.
Teneff, Tontcho
Tompkins, E. S.
Turner, William J.
L.
Linder J.
Linde

# NIAGARA FALLS

Tompkins, E. S. Turner, William J. Vickers, Edward L

Wensley, Roger Lytle Wise, Alfred L.

Carborundum
Anthes, Lester B.
Baumann, Henry N.
Moran, Paul W. F. J.
Papacharalambous, H. G.
Wasson, Robert L.
Strategic Udy Processes, Inc.
Magyar, William B.
Union Carbide Metal Co.
Erasmus, H. de Wet
Evans, Fred L.
Offenhauer, Charles M.
Other

Other Udy, Murray C.

NORTH CREEK

Barton Mines Corp. Barton, Chas. R., Jr. Barton, H. Hudson Harmsen, Lynn

NORTH TARRYTOWN

Self Employed \*Pearse, Hubert A.

OAKFIELD

U. S. Gypsum Co. Miller, George T. \*Runvik, Richard Carl

ORCHARD PARK Other Welch, Richard C.

PEEKSKILL

Other Swartz, Ralph R.

PELHAM MANOR

Other
\*Baker, Raymond F.
Duecker, Werner W.

PIFFARD

Self Employed
\*Austin, William A., Jr. PLANDOME.

Other

Zeckhausen, P. W. PORT HENRY

Republic Steel Corp. Blomstran, Wm. A. Other Scott, Jack R.

PORT WASHINGTON McGraw-Hill Pub. Co Flowers, Alfred E.

Other Erickson, Henry W. Wunder, George W.

POUGHKEEPSIE

I.B.M. Franklin, James W. Other Kienitz, Leroy E.

RETSOF

Inter. Salt Co.

\*Buckley, David L.
Bush, Lewis P.
Martin, Stanley
Truax, Chester N., Jr. Other Goetz, Reuben, G.

REXFORD

Merrill, Delbert J.

RIVERHEAD

Other Taylor, Harold A., Jr.

ROCHESTER

Univ. of Rochester Revel, Humbert S Other Stathis, George J.

ROME

Other Crouch, Thomas S.

RYE

Fenzi, Warren E. Park, John F. Van Naerssen, E. J.

SARANAC LAKE

Saranac Lab. \*Roberts, Malcolm L.

SAUGERTIES Other Warfel, J. D.

SCARSDALE

Kenite Corp.
\*Frankenhoff, Charles A.

Self Employed
\*Garretson, Mary W.
Other
Kahn, Walter C., Jr.
Kursell, H. A.

SCHENECTADY

Alco Prod.
Foley, Dennis D.
General Electric
Charles, Richard J.
Moore, Robert B.
Schwedes, W. H. Other Murphy, Jerimiah F.

SEA CLIFF

Self Employed
\*Schmidt, William C.

SOUTHOLD

Other \*Conover, A. Edward

SOUTH NYACK

Self Employed \*Kay, Fred D.

STAR LAKE

Jones & Laughlin
Djuvik, Carl
Fleck, R. J. Grant
Harker, Richard T.
Lund, Lawrence H.
Peterson, Arthur F., Jr.
West, Fred J. Other Rowand, H. C. Taylor, H. J.

STATEN ISLAND Self Employed \*Dickson, Robert H.

Other
Alexis, Jos H. V.
Hagemann, Lennox L.
Holtz, Theo H.
Wellnitz, Anna M.

STONY BROOK

Other MacKenzle, Thomas A.

SYRACUSE

Allied Chem.

Boggs, William E.

Syracuse Univ.

\*Chute, Newton E.

Coon, Richard F.

TAHAWUS

Nat'l Lead Co.
Begor, Charles R.
Carr, James R.
Chapman, Walter M.
Crane, Gary F.
Dellinger, Brower
Gross, Stanford O.
Hall, John G.
Hatch, Dexter C.
Heinrich, Robert
Heyburn, Malcolm M.
Other

Other her Houlehan, Thos J. Kingman, Robt. I. Morris, Paul E.

TONAWANDA

Other Sanden, Robt. Sulecki, John S. L.

TROY

Renssalaer Polytech. Inst. \*Dunn, James R. Other McCarthy, Peter F.

TUXEDO

Union Carbide Nuc. Co. Aplan, Frank F. Riddle, John A. Selchow, Donald H. Woolery, Robert G.

UTICA

Chicago Pneumatic Tool Co. Hallett, Alfred F. Lear, E. B. Eastern Rock Prod. Inc. Owens, John V.

WANAKENA

Other Vickers, William A.

WATKINS GLEN

Int'l Salt Co. Wrighton, Richard W.

WEBSTER

Other Lauer, Frederick C.

WEST BRENTWOOD Other

Ipsen, A. O. WEST CHAZY

ner Garbesi, Vinton A.

WEST NYACK

N. Y. Trap Rock Co. Dow, Melvin C. McDonough, Donald W. Mead, Robert Eiting \*Schwellenbach, Henry J.

WHITE PLAINS

Geotechnics & Resources, Inc.

\*Mead, William E. Other
Shafer, Robert E.
\*Smith, William E.

WILLSBORO

Cabot Corp. Choate, Lauren W. Lynch, James T. Marchione, Vito R.

Other Rodenhiser, Roy C.

WOODMERE Integrated Mica Corp.
\*Heyman, Moses D.

WOODSIDE

Columbia Technical Corp. \*Ordjanian, Nikit

YONKERS

Self Employed \*Moyd, Louis \*Moyd, Pauline "Moya, a Other Bellows, George D. Cawley, Nevil B. George, Jack W. Maxwell, Henry W. Petrie, Henry J.

YORKTOWN HEIGHTS

Self Employed \*Robie, Edward H.

YOUNGSTOWN

Other Sturges, Donald G.

NORTH CAROLINA

ASHEBORO

Paschal Assoc. Sales Inc. Paschal, R. Fred, Jr.

ASHE COUNTY

Other Lassiter, Robert G.

ASHEVILLE

S. E. Diamond Drilling Co. Jennings, J. P., Jr. Mitchell Dist. Co., Inc. Boone, Roy H. N. C. State College \*McDaniel, William T. \*Wright, Thomas J.

Other McKenzie, Thomas J. Miller, John Gaines Sharp, Harold H.

BESSEMER CITY

Lithium Corp. of Amer. Inc. Harris, Carleton B. McClure, Joseph N.

BURNSVILLE

Hassett Mining Co.
\*Adair, Ralph B.

New York-North Carolina

CHAPEL HILL Univ. of N. C.
\*Mann, Virgil I.

CHARLESTON

Southern Corp. Laine, Robert B.

CHARLOTTE

Hewitt-Robins, Inc. Brown, Gene Scandura, Inc. Montgomery, T. J., Jr.

DUBRIAM

Duke Univ.

\*Berry, E. Willard

\*Heron, S. Duncan, Jr.
Johnson, Walter L.

FT. BRAGG

66th Engr. Co. (Topo) (Corps) Williams, Stuart H.

FRANKLIN

Allman Cove Mining Co.
\*Fouts, Roy Herbert

GASTONIA

Other Robinson, Clyde H.

GERTON

Other Meyer, Harold D.

GOLDSBORO USAF, Seymour-Johnson Phillips, Rex A.

Other Miller, Chester E. GREENSBORO

Faust, William A., Jr. Ferrell, James C.

HAMLET

Other Clements, Albert F.

HAMRICK

Other Sherertz, Joe R.

HENDERSON

Howe Sound Co.

\*Milisapa, Frank W.
Tungsten Mining Corp.
Kendrick, William L.
Malcolm, John B.
Szynklewski, A. M.
Self Employed
Wood, Alexander Hamilton
Other

her Hager, Phipps A. HICKORY

Oth

Other Daniel, Jay R.

JACKSONVILLE

Cooper, John H. Gier, Donald E.

**JEFFERSON** 

Appalachian Sulphides Nameth, Stephen J. Other Eckman, M. A.

KINGS MOUNTAIN

Foote Mineral Co. Flow, Ralph C. Goter, Edwin R. Horst, William E. Johnson, Nell O. Johnson, Neil O. Kesler, Thomas L. \*Lancaster, Paul A.

LINCOLNTON

Lincoln Nat. Conc. Corp. Clark, Walter

MURPHY

The Hitchcock Corp. Bourne, Francis C.

## North Carolina-Ohio

Other Van Horn, Earl C.

### OXFORD

W. E. Graham Hedrick H. Dermont

### PEAFETOWN

Othe Richmond, R. M.

### POPE (AFB)

U.S. Air Force Coffman, Peyton R.

### RALEIGH

N. C. State Museum
Davis, Harry T.
N. C. State College
Hamme, John V.
'Miller, E. L., Jr.
Parker, John M., III
Superior Stone Co.
Maddox, Joseph E.
U. S. Geological Survey
Brown, Philip M.
Other

Other Stuckey, Jasper L.

### ROCK MOUNT

Other Alexander, Jacob L.

### SHELBY

Other Johnson, B. W.

# SOUTHERN PINES

Butler, Howard N.

# SPRUCE PINE

The Feldspar Corp.

\*McMurray, L. L.

The Harris Clay Co.
Dickey, Jerry B.
Lawson-United Feldspar Mineral Co. Lawson, Thomas T.

### TROY

Other Phifer, Sam E.

# WARRENTON

Othe Long, W. Lunsford

# WILSON

Atlantic Christian Co. Hope, Robert C.

# WINSTON SALEM

Other Young, Rawley L.

# NORTH DAKOTA

# BISMARK

Othe Bell, Gordon L.

# GRAND FORKS

Univ. of North Dakota

\*Kohanowski, Nicholas N.
Koth, Arthur W.
Self Employed

\*Erickson, Roland I.
Other Other Cooley, Albert M. Dismant, John H.

# JAMESTON

No. Central Engineers Andersen, R. Douglas

# WILLISTON

Great Northern Railway Co. Reed, Henry E., Jr.

# OHIO

# AKRON

John C. Chew & Associates "Chew, John Carrollton
B. F. Goodrich Co.
Traxler, E. R.
Robinson Clay Prod. Co.
Sutherland, Clark

ALLIANCE

Other Young, Robert C.

### AMHERST

Cleveland Quarries Co.
\*Zukowski, Richard E.

### ASHLAND

Other Foy, C. Benjamin

# AURORA

Rieger, J. C.

# BARBERTON

Babcock & Wilcox Co. Pearson, Leonard Wilcoxson, Leslie S. Other Murray, Robert K.

### BAY VILLAGE

Other Babcock, Donald E.

### REDEORD

Ferro Corp.
Fuchsman, Charles H.
S. K. Wellman Co.
Wellman, S. K.

### BELLAIRE

Other Brockwell, J. A., Jr.

Hanna Coal Co.

Bearce, Wendell E.
Bradford, Thomas P.
Connelly, William P.
Delloma, Cecil M.
Goddard, William P.
Hyslop, Andrew, Jr.
Hyslop, James
McCaa, George W.
Reilly, James D.
Schneider, George G.

### CAMBRIDGE

Vanadium Corp. of Amer. Jordan, Theodore S. Rasmussen, Robert T. C Rathmann, Heinrich W. Roman, Byron S. Oth

# Kuhn, Robert S.

# CANFIELD

Amer. Fire Clay & Prod. Co. \*Day, Britton T.

# CANTON

Amer. Mine Door Co. Gurney, Glenn D. Ohio Ferro Alloys Corp. Landon, Houston S. Timken Roller Bearing Co. Wagner, William P.

# CHESHIRE

Ohio River Collieries Co. Gentile, Tony

# CHESTERLAND

Expanded Aggregates \*Duey, Robert K.

# CHILLICOTHE

Basic Construction Mtls. Neikirk, Charles W.

# CINCINNATI

CINCINNATI
Chem. & Ind'l Corp.
O'Harra, B. M.
Continental Min. Proc. Corp.
Hauck, Frederick A.
Eagle-Picher Co.
Atteberry, William D.
Ingersoil-Rand Co.
Cooper, S. D.
Logan & Kanawha Coal Co.
Inc.
\*Fields, John R.
Nat. Lead Co. of Ohio
Mead, Joseph C.
Processes Research, Inc.
\*Biggs, William F.
Procter & Gamble Co.
\*Smallwood, Norman J.
Chas. Taylor Sons Co.
Maupin, Addison
Truax-Traer Coal Co.
Patton, M. L.

Vulcan Cinc. Inc.

\*Meade, Richard K.
Self Employed
Tobey, Julian E.

# Other

Clayton, Carl W. Nice, John A. Robertson, Alex E. Stilwell, S.

### CLEVELAND.

Amer. Iron Ore Assoc.
Johnson, Hugo E.
Amer. Scale & Control Co.
\*Doversberger, Charles
Amer. Steel & Wire
Ashton, William Howard
Basic Inc.

Ashton, William Howard
Basic Inc.
Casey, John A.
Eells, Howard P.
Martin, Conrad
Muller, Max M.
Pearson, Edward P.
Shurtz, Robert F.
Verner, William J.
Bigelow-Liptak Corp.
MacDonald, William T.
Brush Beryllium Co.
Nunlist, Marshall B.
Butler Bros.
Butler, Patrick
Carbon Processing Co.
Miller, Armon D.
Chesapeake & Ohio Rwy.
DeVine, Gregory S.
Haessler, Edward W.
Cleveland-Cliffs Iron Co.
Harrison, H. Stuart
Hollister, J. B., Jr.
Leach, Hugh J.
McAfee, Alexander
Pakkala, Wayne Al
Sterling, Walter A.
Taber, Robert W.
Westwater, James S.
Consolidation Coal Co.
Ireland, R. Livingston
Diamond Alkall Co.
Meller, Edward L.
A. Hanna Co.
Anderson, Robert F.
Bartholomew, Robert H.
Buford, Jack W.
Butterfield, Howard M.
Chase, Frederic Mason
Heller, Frederick
Ohle, Ernest L.
Phillips, Peter M.
Prendergast, Jas.
Sleeman, Clarence H.
Vedensky, D. N.
Vines, Fred D.
Walker, Alfred E.
Whitney, Richard W.
Harshaw Chem. Co.
Hay, John O.
Hewitt-Robins Inc.
Van Stone, Jim E.
Independent Explosive Co.
Weitz, John C.
Int'l Sait Co.
Bleimeister, Wm. C.
Wade, Robert W.
Itron Ore Mining Dept.
Hassett, J. S.
Lincoln Elect. Co.
Todd, Arthur W.
Com Ore Mining Dept.
Hassett, J. S.
Lincoln Elect. Co.
Todd, Arthur W.
Com Ore Mining Dept.
Hassett, J. S.
Lincoln Elect. Co.
Todd, Arthur W.
Com Ore Mining Dept.
Hassett, J. S.
Lincoln Elect. Co.
Todd, Arthur B.
Com Dowell Co. Inc.
Ban, Thomas E.
Ferere R. O.

McDowell Co. Inc.
Ban, Thomas E.
Ferren, R. O.
Rewen, Allen R.
Rowen, Harold E.
Thompson, Charles D.
Arthur G. McKee Co.
"Cox, Merrill
English, Alan
Greenwalt, Richard B.
Mining Machine Parts, Inc.
Bigler, William Paul
M. & O. Coal Co.
"Ray, Harmon C.
National Castings Co.
Smith, Herbert H.
Yearley, B. C.
National Steel Corp.
Humphrey, George M.
Oglebay Norton Co.
Dadd, Melvin W.
"Fetzer, Wallace G.
Hamilton, W. D.
Hicks, Harold N.
Liffiton, Jack K.
"Martin, Henry K.
Nichols, Walter B.
Sloan, Edward W., Jr.
"Smith, Frank J.

Pickands Mather & Co.
Arms, Charles S.
Carey, Robert S.
Ford, Allen H.
\*Rodney, Hodge D.
Jackson, Herbert C.
Mapes, Edwin J., Jr.
Republic Steel Corp.
Allen, George W.
Chernosky, Frank J.
Coghill, William H.
Eggleston, E. R.
Fitzhugh, Edw. F., Jr.
Hazel, John J.
Kuperus, Cornelis
Liggett, Robert P.
McCleilan, Alex K.
McVicker, Joseph R.
\*Miller, Samuel A.

McClellan, Alex K.
McVleker, Joseph R.

Miller, Samuel A.
Muthig, Robert W.
Slobey, Robert J.
Vellella, Vincent A.
Walburn, Benjamin R.
Seaforth Min. & Ore Co.
McClurg John
Sylvester & Company
Sylvester, George R.
Technical Services Inc.
Gramp, Otto G.
Textor Labs Inc.
Textor, Ralph B.
W. S. Tyler Co.
Cockrell, Edwin E.
Kaufmann, Vincent A.
Kuenhold, Ned
Norlin, John M.
Reed, Albert E.
Valley Camp Coal Co.
Ewig, Harry T.
Richey, Herbert S.
Wellman Engrg, Co.
McDowell, Robert C.
Self Employed
\*Ludwig, Carl
\*Wyman, Clifton L.
Other
Andrews, J. V.

Other ner
Andrews, J. V.
Craig, John J.
Dewey, Charles H.
Galbraith, F. M.
Hunner, Earl E.
Jenkins, J. M.
Johnson, R. L.
Morris, J. Howard
Violetta, Donald C.
Weber, W. H.

# CLEVELAND HEIGHTS

Self Employed Haven, William A. Other Dougherty, R. E., Jr. Gunning, Samuel D.

# COLUMBUS

COLUMBUS

American Nepheline Corp.
Deeth, Harold R.
American Zinc Co.
Fulton, Casear
Battelle Memorial Inst.
Anderson, Richard J.
Brison, Robert J.
Carmichael, Roland L.
Crout, John S.
Ellzey, Vernan W.
Haie, Raymond W.
Langston, Benny
Lund, Richard J.
Minton, David C., Jr.
Richardson, A. C.
Root, G. Stephen
Schatz, Raymond W.
Shea, James F.
Smith, William Lee
Sullivan, John D.
Tangel, Oscar F.
Wesner, Adam L.
Bituminous Coal Research,

Bituminous Coal Research,

Inc.
du Breuil, Felix L.
Garvey, James R.
Grace, R. J.
Saltsman, Robert D.

\*Grace, R. J.
Saltsman, Robert D.
Consolidation Coal Co.
Lee, Arthur L.
Davon, Inc.
Bowman, Richard S.
A. H. Dierker & Assoc.
\*Dierker, Arthur H.
Gleaves Fuel Co.
\*Gleaves, Clifton Berney
Industrial Nucleonics Corp.
Reider, James E.
Jeffrey Mfg. Co.
\*Flint, James A.
Fulford, J. H.
Hebden, Edward H.
Petersen, M. S.
Wilson, J. Edgar M.
Logan & Kanawha Coal Co.
Stilwell, Rodney Frank
Marble Cliff Quarries Co.
Burton, Victor C.
National Elect. Coil Co.
Hatfield, D. Wendell

Kirby, Fred W.
Price, Bailey E.
Ohio Reclamation Assn.
Cook, Larry
Ohio State Univ.
Lamey, Carl A.
\*Lucas, J. Richard
McCaughey, Wm. J.
\*Mueller, Wm. A.
\*Tucker, LeRoy
Sunday Creek Coal Co.
Ong, Phil H.
U. S. Geolog. Survey
Brant, Russell A.
Roeske, Rodney H.
Schopf, James M.
Clyde Williams & Co.
\*Williams, Clyde E.
Other

Other her
Bird, Byron M.
Clemens, John I.
Greer, Robert D.
Jacobs, Daniel A.
Patton, R. M.
Sisk, Connie, Jr.
Warner, Max M.
Tyson, J. T.

### COSHOCTON

Ebony Coal's Inc. \*Ungurean, C. C.

CUYAHOGA FALLS

Other Walter, A. B.

# DOVER

U.S. Navy Mathias, Adrian J.

# ELYRIA

Concrete Masonary Corp.
\*Goudvis, Theodore L.

# FINDLAY

Differential Steel Car Co. Flowers, H. Fort \*Flowers, R. Dudley Hughes, Shelly G.

### FOSTORIA

Basic Inc.
Addis, Edwin M.
Hughey, Vaughn V
Janosfi, Stephen E.

# FREMONT

Other Morris, Peter A.

# GALENA

Other Smith, Frank G.

GARFIELD HEIGHTS

Other Woody, Fred C.

# GYPSUM

U. S. Gypsum Co.

\*Vanhove, Eric A.

# INDEPENDENCE

Republic Steel Research Cameron, James R.

# JACKSON

Other Bailey, Arthur L.

# LAKEWOOD

Other Crist, Robert B. Johnston, V. D. Montgomery, C. R.

# LEETONIA

Thermocel Co. Inc. Bertelsen, Robt. C.

# LOWELLVILLE

Carbon Limestone Co. Chisholm, Robert H.

# MANSFIELD

Ohio Brass Co. Prunty, M. E., Jr. Other Emerson, Leon W.

# MARIETTA

Marietta College Freeland, Jean Pattin Mfg. Co. Dempsey, Joseph B.

Other Skarbek, John S. Wilking, James H.

MARION

Marion Power Shovel Co.
Busick, Adrien F., Jr.
\*Colatrino, Anthony M.
Cornell, Maurice V.
McDaniel Wm. R.
Mosley, Lafayette C. Other Boulter, George W.

MIDDLETOWN

Armco Steel Corp. Enochs, David J. Olt, T. F.

MINERVA

Other Bonta, Earl C.

NEWARK

Rhodes, Richard L., Jr.

OLMSTED FALLS

Ives, Lee E.

OXFORD

Miami University
\*Thoms, John A.

PAINESVILLE

Morton Salt Co. \*Ganong, Russell G.
\*Ryland, Robert R.
\*Trainor, Michael P.

POLAND

Tatman, John L.

SAINT CLAIRSVILLE

B.B.R. Drilling Co Balcar, Frank Other Gibson, Clyde Sullivan, David L.

SHAKER HEIGHTS

Hugus, C. E., Jr. Morgan, Milton F.

SIDNEY

Westinghouse Air Brake Co.

\*Atkinson, Edwin F.
Feucht, Albert
Feucht, Jacob E.
McChain, Robert L.

\*Meyer, Andrew

\*Reinker, N. W.

SPRINGFIELD

Bauer Bros. Co. Wright, J. Howard

STEUBENVILLE

Rabb Coal Co

Pneumatic Parts Co.
\*Nast, Paul H.

STUBENVILLE

McMasters, Ken, Weinman, & Dowdry \*Jenks, E. H.

TOLEDO

Owens-Illinois Richards, Ray S. Other Miller, Emory W.

WADSWORTH

Babcock Wilcox Co. Shewmon, Daniel C.

WELLINGTON

Wedge Wire Corp. Harper, Robt. J. Pearsall, Robert P., Jr.

WELLSTON

McNally Pittsburg Mfg. Co. Wesner, Richard F.

WELLSVILLE

H. K. Porter Co., Inc. Mason, A. Perry

WEST RICHFIELD

Reed, William A.

WORTHINGTON

Paton, R. Douglas Updegraff, Roy A.

WRIGHT PATTERSON AFB

5. Air Force Miatech, Gerald J.

YOUNGSTOWN

Commercial Shearing & Commercial Shearing & Stamping Co. "Chlumecky, Nicholas "Siegrist, Ralph S. Youngstown Sheet & Tube Co. "Braden, Orrin S. Chang, Melvin C. Dicks, Sheldon J. Sharrer, John L Self Employed \*Forman, P. G. Other Bremner, Robt. P., Jr.

ZANESVILLE

Ayers Mineral Co.
Sawyer, Edward C.
Central Ohio Coal Co.
Coulson, Frank
Central Silica Co.
Lincoln, R. V.
Columbia Cement Corp.
Petty, Raymond E.

OKLAHOMA

ALTUS

U. S. Army McKnight, James R.

BARTLESVILLE

Phillips Petr. Co.
Holmes, Clifford N.
Walls, William S..
U. S. Bureau of Mines
Knox, Clinton C.
Netzeband, F. F.
Sanford, Robert S. Other McElvenny, L. T.

CARDIN

Eagle-Picher Co. Brockie, Douglas C. Cuddeback, Frank J. Dingess, Paul R. \*Huddleston, Melvin Moran, Ernest Wetherell, Lloyd E.

ENID

Silver, Edward D.

HENRYETTA

Ben Hur Mine Service Co.

\*Taylor, Gene

LAWTON

Other La Heist, Barbara A.

MC ALESTER

Lone Star Steel Co.

\*Cameron, Campbell R.
Curry, Burrell L.
Lowrie, Raymond L.

\*Padgett, Ward
Other Other Dinsmore, Alex M.

MIAMI

Eagle-Picher Co.
Dale, Claude O.
Hare, Edward H., Jr.
Rhoades, David A.
Rockwell, O. A.

U.S. Geol. Surv. Bailey, Andrew V. Gordon, Lawrence E.

MUSKOGEE

H. G. S. Anderson & Sons
\*Anderson, Hector G. S.
Self Employed
Schrader, Erich J.

NORMAN

Okla. Geological Survey
\*Ham, William E.

OKLAHOMA CITY

Kermac Nuclear Fuels Corp. Cobb, George H. Kerr-McGee Oil Ind. Mattson, Vernon L. McGee, Dean A. Zitting, Richard T.

PICHER

Landis Steel Co. Landis, Miles B. Quapaw Co. \*Childress, Harold L.

POTEAU

Le Flore County Gas & Elec. Co. Orr, James F.

PRVOR

Other Anderson, Anderus J.

SOUTHARD

U. S. Gypsum Co. Woods, Samuel W.

TULSA

Fenix & Scisson, Inc.
Kuklis, Andrew

\*McCarthy, Donald F.
Perrin, James R., Jr.

\*Scharf, Fred
Gardner-Denver Co.
Caldwell, Robt. G.
Kewanee Oil Co.
Parker Norbert A.
Pan Amer. Pet. Corp.
Clark, Joseph B.
Friedman, Gerald M.
Seismograph Service Corp.
Baltosser, Robert W.
Baugh, Billy G.
U.S. Geol. Surv.
Johnson, Edward L.
Self Employed

\*Millikan, C. V.
Other

"Millikan, C. v.
Other
Elkins, Lloyd E.
Nielsen, Merrill L.
Reynolds, K. W.
Richards, Raymond

WEATHERFORD

Other Geffken, John

OREGON

ALBANY

U.S. Bureau of Mines Bishop, Ottey M. Brown, Lawrence L. Fergus, Andrew J. Hess, Harold D. Kauffman, Albert J., Jr. Kelly, Hal J. Kingston, Gary A. Other Town, Joseph W.

ASHLAND

Other Volgamore, John H., Jr.

ASTORIA

City of Astoria
\*Brownson, Lloyd D.

BAKER

Chemical Lime Co.
Thomas, Ned
Oregon Dept. Geol. & Min.
Ind. Brooks, Howard C. Wagner, Norman S.

BEAVERTON

Other Anderson, Colver F.

CORVALLIS

Oregon State Univ. oregon State Univ.

\*Allison, Ira S.

\*Caldwell W. E.

\*Koch, George S., Jr.

\*Wilkinson, W. D.

Seif Employed

\*Gallagher, John H.

Other

\*Gallagher, A. F.
Gallagher, A. F.
Watkins, Kenneth O.

COTTAGE GROVE

Lane Minerals, Inc. Barton, Harold E. L.

EUGENE

Atlas Powder Co. McGuinness, Albert L. Univ. of Oregon \*Staples, Lloyd W. Other Fifer, H. Clay Harlow, Jean S.

FOREST GROVE

Fremont Mining Co.

\*Blair, Frank H., Jr.

\*McKee, John P.

GRANTS PASS

Oregon Dept. Geol. & Min. Ind. Ramp, Lenin Oth ner Robertson, William S.

HILLSBORO

E. A. Messer & Assoc., Inc. Messer, Ernest A.

JACKSONVILLE

Other Maddox, Terry

KLAMATH FALLS

U.S. Bureau of Reclamation Renning, John A. LAKE OSWEGO

Plastics Co. of America \*Poorman, John M.

MEDFORD

Self Employed
\*Ingle, Hugh C.

PORTLAND

Bardy Eng.

\*Bardy, Gordon A.

Bureau of Land Management
\*Smith, Joseph B.

Ivan Bloch & Assoc.
\*Bloch, Ivan
Columbia Steel Castings Co.,
Ivan

Inc.
Bird, Hobart M.
Electric Steel Foundry Co.
Haney, Charles E.
Williamson, R. G.
Farnham Chem. Co.
Farnham, Willard
Gladding, McBean & Co.
Whitney, Eugene H.
Ingersoll-Rand Co.
Leary, John H.
Oregon Dept. of Geol. & Min.
Ind.
Dole, Hollis M.

Oregon Dept. of Geol. & Min Ind.
Dole, Hollis M.
Hoagland, L. L.
Mason, Ralph S.
Aisthews, Thomas C.
Schlicker, Herbert G.
Oregon Steel Mills
Miller, Keith L.
Owens-Illinois Glass
Menoher, Pearson T.
Pacific Carbide & Alloys Co.
Waters, Thomas J.
Pacific Power & Light Co.
Duell, Garth A.
Martin, Robert A.
U.S. Army
"Zwick, Walter H.
U.S. Bureau of Land
Management
Berlin, Leonard M.

Ohio-Pennsylvania

Onio-Pennsylv
Hattan, Elton M.
Oscarson, Roger O.
U.S. Forest Service
Donnhue, Charles V.
U.S. Navy
Cogswell, John H.
Self Employed
Chapman, R. T.
\*Friedle, Frank J.
\*Hines, Pierre R.
\*Libbey, Fay W.
\*Richards, Leslie C.
Other

Other
Bartell, A. O.
Ekstrom, John R.
Fealy, W. A.
Hall, Robert L.
Orr, James M.
Wustrack, O. H.

PRIMEVILLE

Other Sahinen, Winston M.

RIDDLE

Hanna Mining Co.
Maney, Edward J.
Stevens, Richard M.
Hanna Nickel Smeiting Co.
Hard, Herbert W.
Mollard, Earl S.

ROGUE RIVER

Bristol Silica Co. Bristol, Fayette I.

ROSEBURG

Other Thurber, H. K., Jr.

SALEM

Lime Products Co. Leonard, T. T. State Engineer \*Gustafson, Fred D.

SUMPTER

Buffalo Mine Jackson, James P., Jr. Self Employed \*Woodwell, Arthur H.

THE DALLES

Harvey Aluminum Loevenstein, Hirsch

Self Employed \*Mears, Henry S.

TROUTDALE

Reynolds Metals Co. Hanson, Richard L. Shoemaker, Henry W.

PENNSYLVANIA

ALLENTOWN

ALLENTOWN

Air Products, Inc.

\*Antakt, Victor N.
Allentown Fortland Cement
Co.
Myers, Philip B.
Allis-Chalmers Mfg. Co.
Dandois, Charles E.
Lehigh Portland Cement Co.
Warmkessel, Carl A.
Yost, Charles W.
Traylor Engrg. & Mfg. Div.,
Fuller Co.

\*Evans, William H.
Kramm, Douglas J.
Most, Arthur C., Jr.
Witmer, B. Franklin
Trojan Powder Co.
Dowling, Thomas P.
Griffith, George L.
Knotts, George F.
Other

Eckman, Hanry A.

Other Eckman, Henry A. Jacobs, Robert Mc Inerney, Robt. M.

ALTOONA

Gwin Engineers, Inc. \*Foreman, John W

ANNVILLE

H. E. Miliaro Co. Williams, Earnest D., Jr. E. Millard Lime & Stone Pennsylvania-Pennsylvania

ARDMORE

Maryland Coal & Coke Co. Jordan, T. Gihon Other Matthies, Albert J.

ASHLAND

Laubenstein Mfg. Co. Laubenstein, A. R. \*Middleton, Harold R. Other Seiler, Geo. M. Waskovich, M. J.

ASHLEY

Glen Alden Corp.
Powell, Edward T.
\*Waslofski, Walter B.

ATLAS

Other Bridy, Edward A.

AVOCA

Other Mc Dade, John B.

BAINBRIDGE

Polishing Control & Research de Vitry, Pierre

BARNESBORO

Barnes-Tucker Co. Todhunter, John S. Other Todhunter, William

BATH

**Keystone-Portland Cement** Maurer, Paul F. Michaels, Harry J.

BEAVER

Other Thompson, C. Vance

BEAVER FALLS

Babcock & Wilcox Hamilton, Ne rell

BEDFORD

Kennametal, Inc. \*Carroll, Edward J Saxman, Duane S. Steel, John P. Turoski, Stanley A. Welch, Dick W. Other Shannon, Spencer S.

BELLEFONTE

Natl. Gypsum Co.

\*Carlson, John L.

Pinto, Joseph, Jr.

Schweitzer, Donald R. Warner Co. Corre, Herschel A. Other Gustafson, Harold F.

BENTLEYVILLE

Conrad, Olen E. BETHEL PARK

Self Employed
\*Paulick, Paul R. Other

Gent, L. D., Jr. Pyle, Paul P. Ruttle, Eugene T.

BETHLEHEM

Bethlehem Steel Co.

\*Adair, George L.

Biemesderfer, George K.
Cherkis, John J.
Dominguez, E. C.
Entrekin, Paul B.
Erickson, Edwin S., Jr.
Foster, James C.
Fox, Sidney V.
Fraser, Donald M.
Frith, Douglas L.
Guider, James W.
Hitzrot, Henry W., Jr.
Horst, Russel J.
Howells, Edgar H.
Kaufman, August T. Kaufman, August T. Keiler, John A. Kettering, Michael H.

Lake, Simon, III
Limons, Robert A.

Lynn, John D.
Lyons, Daniel S.
Mahood, G. Phillips
Mancke, Edgar B.
McIlwain, Hugh T.
Neff, Melvin A.
Nicholson, Bruce J.
Peterson, Arthur F.
Starr, Fisher M.
Tebelman, Charles G., Jr.
Telfair, Peter
Van Nuys, Francis
Ward, Staniey A.
Lehigh Navigation Dodson Co.
Frable, Foster F.
Lehigh University
Brune, Arthur W.
Gallagher, Robert T.
"Gault, H. Richard
Horak, George C.
Other
Cumings, William S.

Other her Cumings, William S. Dick, Charles J. Fretz, A. Henry Hole, Gilbert L. Leach, Edward P. Perhac, George A. Rankin, W. A. Waite, Earle C. Warriner, Jesse B. Warriner, Jesse B Weicker, Raymon ond W.

BLAIRSVILLE

North American Gear Co.
\*Duchnowski, Henry
Edward
\*Graff, Paul W.

BOLIVAR

Garfield Refractories Co. Rugh, Keneth A.

Imperial Coal Corp. Haynes, William R.

BOYERTOWN

Kawecki Chemical Co Kawecki, Henry C.

BRACKENRIDGE

Allegheny Ludlum Steel Corp. Hilliard, Glenn E.

BRIDGEPORT

Bethlehem Limestone Co. Ellington, Thomas S. Leedecker, Earl K.

BROCKWAY

Brockway Glass Co.

\*Locotos, Frank M.
Robertson, Leon Forest
Self Employed

\*Peterson, Carl A.

BROOMALI

Longo, John S.

BRYN MAWR

Bryn Mawr College \*Watson, Edward H.

BUTLER

Heckett Engr. Co. Jones, Wilbur K. Spang & Co. Rath, Robert A. Other Hagen, Robt. E.

CALIFORNIA

Jones & Laughlin Steel Corp. Hess, Wm. E. Howe, Donald C. Reilly, J. J.

CAMP HILL

Other Cooper, Edward, Jr.

CARBONDALE

Henrick Mig. Co. Colville, Kenneth H., Jr. Blackburn, D. M. Dann, B. C., Jr.

CARLISLE

Carlisle Corp. Dixon, George F.

CARNEGIE

S. P. Kinney, Engrs., Inc. \*Kinney, S. P. Other Brisse, A. H.

CATASAUQUA

Fuller Co.
Burnell, Henry J.
\*Cohen, Sidney Martin
Johnson, Robert M.
Williams, John C. Other

Douglass, A. E., Jr. CENTER VALLEY

N. J. Zinc Co. Childs, Mark S. Forsyth, William T. Hardie, Robert C. Huyett, Sterling S. Mitchell, Steve Moebs, Noel N. Wiles, Harold B.

Other Seip, Robert H., Jr.

CHAMBERSBURG

T. B. Wood's Sons Stuard, Samuel S.

CHARLEROI

Lee-Norse Co.

\*Arentzen, Einar Martin

\*Fitzgerald, Harry J. Self Employed Rodgers, Wesley P.

CLARKS SUMMIT

International Salt Co. Parrish, Floyd G. Ryon, John L., Jr. Other Conroy, W. E. Keenan, Alan F., Jr.

CLEARFIELD

Maple Hill Coal Co.
Davidson, Alan R.
Penbrook Contr. Corp.
Crum, Stanley E.
D. C. Penoyer & Co.
Penoyer, Robert C.

COATESVILLE

Lukens Steel Co. Potter, Horace W. Steidle, Howard

COLMAR

Link-Belt Co. Bottorf, Robert G.

CONNELLSVILLE

Connellsville Corp. Lepley, Russell L.

CONVNGHAM

Owens, Harry C.

COOPERSBURG

Other \*Seaman, Lawrence

CORAOPOLIS

Am. Mine Chem. Co. Messer, Leonard

CORNWALL

Bethlehem-Cornwall Corp.
Bernhardt, Joseph
Bonamer, Donald G.
Brown, N.
Eben, C. Frederick
Ketter, Richard P.
Lipensky, Milan
Neil, Charles R.
\*Renfrew, Robert T., Jr.
Rogich, Donald G.
Shale, Sheldon J.
Taylor, Charles E., Jr.
\*Weik, William J.
Wheeler, Robert M.

CREIGHTON

Other Kuchta, Bernard R.

CRESSON

Other Evans, M. Albert

CRUCIBLE

Crucible Mine Min, Zin

DALLAS

Self Employed \*Mulcey, Paul A 

DALTON

Other \*Dennen, William L.

DANVILLE

Other \*Pursel, Robert N.

DEVON

Other Schaberg, B. F.

DREXEL HILL

Other Gillan, Charles A., Jr. White, Paul F.

DRIFTON

Coxe Estates
\*Coxe, Daniel M.

DRUMS

Other Kay, W. W.

DU BOIS

Kline Engrg. & Contr. Co. Kline, F. C. Other Gillett, G. Marshall

DUNMORE

Turnpike Coal Co. Vitali, Angelo

DUQUESNE

Other Wright, Ralston E.

EAGLES MERE

Other Holstein, L. S.

EASTON

Alpha Portland Cement Co. Alpha Portland Cement C Ames, John A. Brownstead, Ernest F. Eastern Car & Const. Co. Farrell, Cottrell Gen. Crushed Stone Co. Parton, W. Julian Self Employed \*Bailey, E. G.

EAST PITTSBURGH

Westinghouse Elec. Corp.
Ivy, Joe G.
Rector, B. E.
Risler, Clark B.
Thomas, Walter E.

EBENSBURG

Other Ferguson, Peter A.

ELDRED National Powder Co. Pinkey, Leonard A., Sr.

ELKINS PARK Self Employed \*Agocs, William B.

ELLSWORTH

Other Sprague, Luther S. EMMAUS

Andre, Henry Ernest

ERIE

Eriez Mfg. Co. Merwin, Robert F. Gen. Elec. Co. \*Brauns, John W.

FLOURTOWN

Other Stevens, David W., Jr.

FORTY FORT

Chapin, Cyrus W. Decker, R. G. Meyer, Karl A. Rachunis, William

FRACKVILLE

Read Realty Co. Haupt, David F. Self Employed \*Lewis, Thomas J. Other Klees, E. M.

FRANKLIN

Chicago Pneu. Tool Co. Reich, Wendell L.
Joy Mfg. Co.
Barrett, A. Lee
McElhattan, Kent E.
Osgood, Charles F. Other Rollins, Lester G.

FREELAND.

Other Poleri, Ralph

GILBERTON

Gilberton Coal Co. Schnee, Garfield A.

GLENN MILLS

The General Crushed Stone Co. \*Kemery, Harry W.

GLENSIDE

Russell Bryan & Assoc.
\*Oftelie, Thomas C.

GOODSPRINGS

Penag Coal Co.
\*Riedel, Alfred B.

GREENSBORO

U.S. Steel Corp. Coe, G. Dale Durfee, John C. Kennison, Jack A. Other Engoti, Joseph R.

GREENSBURG Allegheny Pittsburgh Coal Co Walter, Richard J. Jamison Coal Co. Jamison, David S. Jamison, Will B. Old Republican Ins. "Glane, Arthur Stuart Safety Development Corp. Barnes, Robert W. Other Kelley, Jay H. Schubert, Rudolph R. Tenley, James L.

GWYNEDD VALLEY

Other Enck, Ernest G.

HAMLIN U.S. Army Gale, Paul B.

HANOVER Bethlehem Limestone Co. Thomas, Francis H.

Spooner, William H.

Other

HARRISBURG Andrew S. McCreath & Son, Inc.
\*Pennington, F. A.

Pa. Dept. of Forests & Waters
Montgomery, Hugh B.
Pa. Dept. of Mines & Min.
Becker, Norman F.
Brecker, George A.
Maize, Clyde H.
Pennsylvania Turnpike
Other

\*Smith, James D. S. Geological Survey Jones, Benjamin L.

## HAVERFORD

Warner Vaughan Co. Vaughan, Warner G. Other \*Humphrey, E. P.

# HAZLETON

HAZLETON

Barrett, Haentjens & Co.
Haentjens, R. P.
Haentjens, Walter D.
Moscon, John A.
Rubert, Charles D.
Central Pa. Quarry Stripping
& Constr. Co.
Butler, W. C. Morris
Butler, William C. M., Jr.
\*Lamont, Ralph C.
Welliver, Robert M.
Chisnell Coal Co., Inc.
Chisnell Goorge M.
Correale Construction Co.
Altmiller, C. Henry, Jr.
Beacher, Arthur F.
\*Correale, Fred R.
Dick Construction Co., Inc.
Dick, Donald B.
Keuch, Luther E.
Frank Swabb Equip. Co.
Swabb, Frank L.
Vibration Engrg. Co.
Patton, Francis A.
\*Petro, Anthony J.
Fowers, Edward R.
Self Employed
\*Wilson, John H.
Other
Boddin, Charles H.

Other her
Boddin, Charles H.
Capparell, S. T.
Correale, Palmer
Garner, Carroll A.
Mitchell, D. L.
Roderick, David J.
Schwartz, Arthur D.

# HOLIDAYSBURG

Other McKague, H. L.

# HUNKER

Delmont Fuel Co. Jamison, Richard H., Jr.

# IMPERIAL

Other Kislosky, Chester

# INDIANA

Rochester & Pittsburgh Coal Rochester & Pittsburgh ( Co. Bullers, Walter E. Calhoun, P. P. Cheely, Edgar M. Hunter, Raiph M. Kennedy, George H. Potter, Charles J. Schaeffer, James J. Sherwin, Lee A. Self Employed

Self Employed \*Barrett, Orrin T. Other Bobella, John C.

Irwin-Sensenich Corp. Sensenich, Chester G. Sensenich, Gary F.

# ISABELLA

Nat'l Mines Corp. Rigg, Geo. M.

Jeddo Highland Coal Co. Davis, Edward E. Holland George H. Jones, Wilmot C. Jones, Wilmot C. Markle, Donald Markle, Donald, Jr.

# **JENNERS**

Ely & French \*Ely, Richard C.

Other Sebastianelli, E. R.

## JOANNA

Other Carthew, Douglas

# JOHNSTOWN

JOHNSTOWN

Bethlehem Mines Corp.
Chalfant, L. Homer
Hannigan, C. J.
Korber, Edmund J.
Reed, Robert P., Jr.
F. E. Cooper Lumber Co.
"Sherrard, Jacob H., Jr.
Crichton Coal & Coke Co.
"Crichton, Andrew B., Jr.
Hinks & Locher Eng. Inc.
"Hinks, Warren Henry
Hurley & Hinks
"Hinks, Warren H., Jr.
U. S. Rubber Co.
Rostosky, A., Jr.
Other

Cressman, Chas S. Slick, E. E. Stanton, Vincent A.

### KING OF PRUSSIA

Bethlehem Limestone Co Jones, Thomas H., Jr.

### KINGSTON

Other

Elec. Storage Batt. Co.
Kehl, C. Joseph
Joy Mfg. Co.
Esler. T. Clyde
Standard Equipment Co.
Powell, Asher
Traher. Harold G.
State Equipment Co.
Wright, Lundy R.
Self Employed
"Geise, William B.
"Kenworthy, O. E.
Other

her Biscontini, A. L. Corgan, Daniel L. Corgan, John B. Corgan, Leo R. Corgan, Leo R. Corgan, William H. Gleason, Benjamin Hutcheson, Allen F. Kudlich, Franc E. Moran, Francis A. Whaite, R.

# KITTANNING

Ringgold Corp.

\*Moore, Philip C.

# LACKAWANNA COUNTY

Evans, C., Jr.

# LANCASTER

Mayo Tunnel & Mine Equipment Mayo, Robt. S.

# LANGELOTH

American Metal Climax

\*Wheeler, Ernest S.

Climax Molybdenum Co. of Pa. Toerper, Ralph C.

# LANSFORD

Lehigh Coal & Navigation Co. Arner, Henry E. Evans, Evan Sterner, Francis E.

# LATROBE

Am. Cyanamid Co. Gieseke, E. W. Kennametal, Inc. Engle, Edgar W. McKenna Philip M. Miller Run Coal Co. \*Phemister, Harry I.

# LAURELDALE

Other Thomas, Russell C.

# LEBANON

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Ball, Samuel S.
Harmon, Richard C.
Schumacher, Charles R.
Bethlehem Steel Co.
Aubrey, William M. Frederiksen, T. R. Larpenteur, Bernard J. Calcite Quarry Corp. Patton, George E., Jr.

NANTICOKE

Glen-Nan Coal Co.
Geoppert, Albert R.
Haas, Raymond F.
Susquehanna Collieries
Gibbons, Charles Allen
Jones, Donald W.
Other

Other Christian, Wm. E. Davis, Thomas E. Kienzle, Geo H. Lee, Walter

Other Bianchetta, P. F.

Lone Star Cement Co Embree, Francis P Nazareth Cement Co. Scott, Herbert J.

Penn-Dixie Cement Corp. Scott, Richard P.

Buckeye Coal Co. Connor, Jack W. Hanish, William R. Lindstrom, C. J. Trevorrow, George C., Jr.

Greenwood Stripping Corp. Branch, Richard

Cameron International Corp. Gibson, Kenneth H.

Lawrence Co. Kurtz, E. L. U. S. Steel Corp. Luttrell, Eugene M.

Other Micco, John C. Otto, John F.

NEW KENSINGTON

Castor, John W. NORRISTOWN

Other Milos, John \*Schenck, W. Phillips

Other Anthony, Stanley E.

Hulburt Oil & Grease Co. Graff, J. Malcolm

her Casella, Patrick J. Pagnotti, Joseph R. Pagnotti, Louis J., Jr. Ventre, Henry

Other Eckhardt, E. A. Lamb, George A.

OAKMONT

OLD FORGE

ORWIGSBURG Other Jones, John Edward

Other Gillingham, T. E.

J. Zinc Co. Brubaker, D. Gordon Fetterolf, Luther D. Fuller, M. Luther Lupton, D. Keith Rodda, John Landon

Allen-Sherman-Hoff Pump

Other McGarry, Phillip E.

Ashe, Donald G Diamond, Andre nd. Andrew J.

PALMERTON

OXFORD

Dragon Cement Co. Anderson, Frank J. Lehigh Valley Air Poll. Cont. Doherty, R. Emmet U. S. Steel Corp. Feenstra, William Schank, Charles G.

NORTHAMPTON

NARVON

NAZARETH

NEMACOLIN

NESQUEHONING

NEW CASTLE

Other er Pegan, Lloyd V., Jr. Meyer, Simon J. Moyer, William H., Jr. Walter, A. R.

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Other \*Elsasser, Charles B.

### LEWISBURG

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# MAHONOY CITY

Kershetsky, Jos T. Meyer, Frank J.

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Mather Collieries Brooks, J. Allan

# McADOO

Hartman Coal Mining Co. Hartmann, Waldemar

### MOHNTON

Other Stickler, Chas. W.

# MONACA

St. Joseph Lead Co. Long, Carleton C. Mitchell, Robert F. \*Najarian, Herand K.

# MONESSEN

Pittsburgh Steel Co Bailey, David R.

# MONROEVILLE

U. S. Steel Corp. S. Steel Corp.
Burch, Elza F.
Glendenin, J. D.
Powers, William H.
Price, J. Gordon
Reed, Thomas F.
Shoenberger, R. W.

# MONTOURSVILLE

Hoyt, Charles D.

# MORGANTOWN

Bethlehem Cornwall Corp.
Anspach, David M.
Bingham, John P.
Leske, Reinhold H.
Moulds, Donald G.
Seifert, David E.
Sheary, George W., III
Sleeman, Robert W.
White, Frank P.
Bethlehem Steel Co.
\*Horn, Alfred C.
McCann, Robert M.

# MORRISVILLE

Other Webb, Wm. R.

# MOUNTAIN TOP

Biscontini, Arnold

# MT. CARMEL

Other Maginnis, Joseph B.

# Pennsylvania-Pennsylvania

Jensen, Robert M. Keyser, James M. B. Stephenson, William B. Foote Mineral Co. Albrecht, Theodore J.

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Other Corazzi, Peter A. Stonebraker, W. I.

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Jensen, H.
Allis-Chalmers Mfg. Co.
Seward, Donovan R.
Berwind-White Coal M Berwind-White Coal Minin
Co.
Berwind, Chas G.,
Berwind, Chas G.,
Pfahler, Robert G.
Willing, Thomas J.
Blocked from Corp. of Am.
Puskar, Victor
Chain Belt Co.
DeMott, Robert W., Jr.
Combustion Engineering Co.
Ellis, Robert S.
Consolidation Coal Co.
Hanson, Victor D.
Drexel Institute of Technology Mining

Robins, James H.
Elec. Storage Battery Co.
Venuto C. Joseph
Foote Mineral Co.
Hudspeth, William R., Jr.
Raynor, Wm. M.
Shay, Felix B.
Gardner-Denver Co.
Malmgren, Carl E.
Tolosky, Roger R.
Gartner, Griswold, McLean &
West, Alan D.
Gen. Refractories Co.
Rappold, William F.
Thorpe, Drew M.
Girard Estate
'Millington, William P.
Greenberg Engrg. Co.
'Greenberg, Wm. B.
Grubnau Bros., Inc.
Grubnau, V. Carl
Hulburt Oil & Grease Co.
Walters, Howard A.
Janney, Dulles & Battles,
Inc.
Focht, Doster
Johnson-March Corp.
Mau, George A.
E. J. Lavino & Co.
'Dill, W. Edwin, Jr.
Dykstra, Franz R.
Heck, Frank G.
Leith, Andrew
Miller, Jesse A.
Montgomery Scott & Co.
Bayley, W. D.
Morrisdale Coal Min. Co.
'Wigton, Robert W., Jr.
Pennsylvania R.R. Co.
Teichman, Richard A.
Geo. F. Pettinos, Inc.
Harris, Arthur T., Jr.
'Pettinos, George F., Jr.
Pettinos, Lewis McM.
Scott Paper Co.
'Mateer, Raymond G.
Stephano Bros.
Stephano, Constantine S.
Stonega Coke & Coal Co.
Knode, Ralph H.
United Engs. & Constructors, Inc.

United Engs. & Construct Inc.

\*Peller, Leonardo
Warner Co.

\*Shoemaker, E. L.
Westmoreland Coal Co.
Gallagher, William A.
Self Employed
Chambers, Gordon H.
Moerk, Frank N.
Other

Moers, F. Donnell, F., Jr.
Batzer, M. M.
Downing, Thos. F., Jr.
Griggs, Charles C.
Wetter, J. William

# PHOENIXVILLE

Phoenix Steel Corp. Freeman, H. B., Jr.

# PITCAIRN

Other Kantor, Andrew J.

# Pennsylvania-Pennsylvania

PITTSBURGH

Allis-Chalmers Mfg. Co.
Beglinger, Richard T.
Aluminum Co. of America
Brown, Charles K., Jr.
Franke, Herbert A.
Harrison, Edward, Jr.
Litchfield, Lawrence, Jr.
McWilliams, Jack H.
Miller, Roy F.
Neustaedter, James A.
Streepey, Geo. W.
American Metallurgical Prod.
Bolkcom, Wilbur T.
Ashland Oil & Refining Co.
Bradbury, Ernest S.
Auburn & Associates Inc.
Ashurst, Oswald P.
Geo. S. Baton & Co.
Castoty, Henry E.
Consolidated Coal Co.
Cassidy, S. M.
Gambs, Gerard C.
Gasper, Donald
Hall, Ernest P.
Ireland, Melville H.
Kirk, Earl C.
Love, George H.
McElroy, Jennis L.
Pursglove, Joseph, Jr.
Shoemaker, G. Albert
Sylvander, Nels E.
Crucible Steel Co. of Am.
Muns, George E.
Schenck, George H. K.
Tillson, Chas B., Jr.
E. P. Dandridge Co.
Herb, James H.
Dictating Equip, Corp.
Bonning, A. Tanner
Berg, Philip J.
Cox, Kenneth C.
Engelleitner, W. H.
Nilsen, A. A.
Phelps, Donald D.
Porteus, John H.
Price William L.
E. I. du Pont de Nemours
Quin, Robert A.
Duquesne Light Co.
Draper, John C.
Elkin, James E.
Younkins, James A., Jr.
Eastern Gas & Fuel Assece

Younkins, James A., Jr.
Eastern Gas & Fuel Assoc.
Allsbrook, S. T.
Basile, Joseph C.
Black, J. Robert
Boxley, A. P.
Burton, Earle B.
Gregory, Vane R.
Griffin, John P.
Kalasky, John D.
Krickovic, Stephen
Llewellyn, R. L.
Nash, Edgar
\*Rothenhoefer, Waiter
\*Sawyer, Chas. H.
Taylor, Edward B.
Eavenson, Auchmuty & Gre

Eavenson, Auchmuty & Green-

Taylor, Edward B.
Eavenson, Auchmuty & Gree
wald
\*Auchmuty, R. Laird
\*Greenwald, E. H.
The Eimco Corp.
Arabia, Lewis
Emerald Coal & Coke Co.
Affelder, William L.
Cornelius, Clinton C.
\*Jackson, Thomas C.
Stevenson, W. G.
Eguitable Gas Co.
\*Tilton, James G.
Flishback & Moore
Gallagher, Pat V.
Freeman & Leech, Inc.
\*Leech, W. A., Jr.
Gardner-Denver Co.
Nichols, Donald C.
General Electric Co.
Kingsley, Harry G.
Goodman Mfg. Co.
Cogrove, John C., Jr.
Guif Research & Dev. Co.
\*Singh, Madan M.
Trump, Robert P.
Wyckoff, Ralph D.
Harbison-Walker Refr. Co.
Birch, Haymond E.
Cook, Charles P.
Galbraith, Scott P.
Galbraith, Scott P.
Wicken, Oscar M.
Wilhelm, Daniel C.
Hercules Powder Co.
Keileher, Robert F.
Shiel, Robert J.
Heyl & Patterson, Inc.
Blair, James P.
Walker, J. L., Jr.
Internal Revenue Service
Dodge, Charles H.

Interstate Equip. Corp.

\*Vogel. Leo J.
Island Creek Coal Sales Co.
McCarthy, Jerome C.
Jeffrey Mig. Co.

\*Howell, John P.
Jones & Laughlin Steel Corp.

\*Bernstrom, Bernard W.
Beutner, Edward L.

\*Brown, Dwight C.
Cooper, Emmit R.
Crump, Robert M.
Getty, William P.
Hanley, William P.
Hanley, William P.
Hanley, William P.
Henning, Carl C.

\*Kunde, Marvin A.
Leber, John W.
Lichy, Charles M.
Morris, Jalk E.
Peterson, Harry S.
Potter, Chas. L.

\*Stowasser, William F., Jr.
Turner, Howard S.
Joy Mig. Co.
Archibald, Donald L.
Butters, Howard E.
Calder, A. William
Courtright, John P.
\*Pelderman, Lloyd G.
Helmick, Louis G., Jr.
Lee, Arnott J.
Lehner, Ray A.
\*Montag, Harold A.
Morrow, J. D. A.
Nyquist, Hugo C.
\*Roehrer, Fred
Russell, John D.
\*Sheriger, Paul M.
Smith, Darrell
Starbuck, David Lent
Van Houten, Herman
Wearly, William L.
Koppers Co., Inc.
Donath, E. E.
\*Parks, James C.
\*Rose, Ernest H.
Thiessen, Gilbert
Link-Belt Co.
Werner, O. W.
Migrs, Light & Heat Co.
Rosner, Robt. A.
McGraw-Hill Publishing Co.
Ginder, William H. H.
Mine Safety Appliance Co.
Bright, Graham
Deike, George H., Jr.
Donahue, C. M.
Hogan, John E.
Johnson, Henry R.
Redenbaugh, Harry E.
Ryan, John T.
White, Everett M.
Natoc Corp.
Augsburger, Clyde
Nati, Mine Service Co.
Bradley, Earl A.
\*Jenkins, G. Stuart
Lamborn, R. Park, Jr.
Marce Corp.
Augsburger, Clyde
Nati, Mine Service Co.
Bradley, Earl A.
\*Jenkins, G. Stuart
Lamborn, R. Park, Jr.
Marce Corp.
Augsburger, Clyde
Nati, Mine Service Co.
Bradley, Earl A.
\*Jenkins, G. Stuart
Lamborn, R. Park, Jr.
Marce Redenbaugh, Harry E.
Ryan, John T.
White, Everett M.
Natoc Corp.
Augsburger, Clyde
Nati, Mine Service Co.
Bradley, Earl A.
\*Jenkins, G. Stuart
Lamborn, R. Park, Jr.
Marce, Co.
Rochafer, Richard G.
Schafer, Robert L.
Pittsburgh Pote for Co.
\*Roller, William Co.
\*Melvins, John H.
Parae, Richard G.
Schafer, Robert L.
Petnaydian, John E.
Onnaher, A.
J. F. Pritchard & Co.
Spangler, Carl V.
James A. Redding Co.
Rochafer, Richard G.
Spangler, Carl V.
James A. Redding Co.
Rochafer, Robert L.
Pittsburgh Cok

U. S. Bureau of Mines Dowd, James J. Evans, Robert L. Gray, Thomas E. Josephson, G. W.

Lowry, H. H.
Magnuson, Malcolm O.
Mahan, Warren M.

Maize, Earl R.

McKinley, Reid B.

Merritts, William M.
Miller, Thomas C.
Nagy, John
Palowitch, Eugene R.

Polack, Samuel P.

Shields, Joseph J.
Thomas, Edward
Thomson, Robert D.
S. Steel Corp.
Barnhart, Arthur C.
Barnhare, J. J.
Breitenstein, J. J.
Breitenstein, August J.
Breitenstein, J.
Ferguson, J. Robt., Jr.
Fisher, Warren E.
Gray, James C.
Hosmer, Henry L.
Keller, George E.
Kinnear, James M., Jr.
Knapp, R. Herbert
L'Espérance, Robert Louis
Martin, James S.
McMorris, Wm. L., Jr.
Morris, Roger D. C.
Nelson, E. B.
Peterson, Almer J., Jr.
Richards, Paul L.
Stacy, Maurice C.
Sweeney, James F.
Talman, Woods G.
Thomas, Donald M.
Werft, Harold H.

Williams C. H.

"Wilson, Philip J., Jr.
Univ. of Pittsburgh

Dines, Edward A.

"Flint, Norman K.

"Tartaron, Francis X.
Westinghouse Elec. Corp.
Stevenson, George P., Jr.
Tallon, Walter A.

Stevenson, George F.,
Tallon, Waiter A.
J. W. Woomer & Assoc.
\*Boyd, John T.
Hinkle. Melvin E.
Thomas, Lawrence M.
\*Woomer, J. W.
\*Workman, William A.
Self Employed
\*Alford, Newell G.
\*Campbell, L. C.
\*Griffen, John
\*Lesher, Carl E.
\*Morrow, James B.
\*Palmer, Rufus N.
\*Redmond, John C.
\*Rose, Harold J.
\*Russell, Charles C.
Shipley, Grant B.
Other

Shipley, Grant B.
Other
Barrett, Jas. L.
Barry, Anthony J.
Bitner, A. Wayne
Blandford, Thomas E.
Cooper, M. D.
Dasher, John
Dodworth, James R., Jr.
Eathorne, William
Feitler, Stanleý A.
Greenwald, Harold P.
Haien, Jack D.
Hair, Richard T.
Hebley, Henry F.
Heyborne, Lester S. Hebley, Henry F.
Hebley, Henry F.
Heyborne, Lester S.
Kebblish, Wm.
Kennedy, Julian, III
Maddox, Philip S.
McBride, George C.
McElroy, George E.
Queer, Thomas H.
Rice, Owen R.
Strod, A. J.
Sturges, Frank C.
Thiessen, Linwood
Tisdale, Rowland A.
Toering, A. J.
Weldlein, Edward R.

PITTSTON

Pagnotti Coal Co. Tedesco, James J.

PLYMOUTH

B. & D. Coal Co.
Bird, James T.
G. & W. H. Corson, Inc.
Allen, John R.
Other
Davis, John W.

POTTSVILLE

J. Robert Bazley, Inc.
\*Bazley, J. Robt.
Hughes, Harry H.
Menzies Engrg. Co.
Leisawitz, A. Harold Leisawitz, A. Harold
Phoenix Cont. Co.
Jones, Wm. L., Jr.
Reading Anthracite Co.
Brown, Charles E.
Davies, John W.
"Geho, Charles H.
McCall, John F.
Morgan, Edmund F.
Pearson, Frederick C.
Prosser, John W.
Williams, W. G.
Reserve Carbon Corp.
"Clark, George J.
R. L. Suender Cont. Engrs., Inc.

Inc.
\*Suender, Russell L.

Self Employed
Chesney, Francis W.
\*Lamont, L. D.

\*Lamont, L. L. D. Other
Bazley, James R., Jr.
Brennan, Mart F.
Heer, Wesley I.
Ingersoll, D. E.
Jones, William L.
Lynch, Edward A.
Martz, Lloyd L.
Williams, R. Y.

PHNYSHTAWNEY

Hoffman Bros. Drilling Co.

\*Hampton, William H.
Other
Bullers, Wm. I.
Stahl, R. Ward

RAVEN RUN

Other Williams, Walter B.

READING

Beryllium Corp.
\*Forbes, Jachin M.
Reading Tube Co.
Arnot, H. J. Other Crosby, Richard E.

RUFFSDALE

Ruffsdale Coal Co., Inc. \*Beattie, Harold L.

SALTSBURG

Joy Mfg. Co. Wiebe, Donald

SCHUYLKILL HAVEN

Lincoln Anthracite Co.
Fox, Edward G., III
U. S. Bureau of Mines
Brady, George A.
\*Eckerd, James W.
Jacobs, Howard D.
Link, Howard B.
Schimmel, John T.
Self Employed Schimmel, John 1 Self Employed \*Smith, Gordon E. Other Bailey, Harold L. Buch, John W.

SCRANTON

Acker Drill Co.

\*Roth, William B.
Erie-Lackawanna R. R. Co.
Ruth, Harry M.
Herold Mig. Co., Inc.
Herold, Waiter L.
Hudson Coal Co.

\*Zink, Charies G., Jr.
Ingersoil-Rand Co.
Earl, John C.
Wallace, James D.
Mine Safety Appliance Co.
Walsh, Robert R.
Moffat Coal Co., Inc.
Lamb, Earl W.
Pennsylvania Appraisal Co.

Lamb, Earl W.
Pennsylvania Appraisal Co.
\*Bell, Robert W.
Penna. Coal Co.
Rogers, Alfred J.
Pierce Management, Inc.
Gustafson, Karl E.
\*Marshall, John S.
\*Pierce, James H.
\*Weysser, John L. G.
Sprague & Henwood, Inc.
Fornwald, William L.
Longmore, Herbert J.
Ross, Adrian E.
Ross, James A.
Schank, Wm. J.

Wyoming Valley Improve-ment Co. Griffiths, John T. \*Petzold, Walter B. "Petzoid, Waiter B. Self Employed Fillmore, G. B. "Lesser, William H. Other Jones. John C. Lambert, Ralph A. Otto, Henry H.

SEWARD

Conemaugh Mining Co. Bucklen, Okley B.

SEWICKLY

Other Kennedy, James P.

SHAMOKIN

M. A. Hanna Co. Moore, W. H. Penag Coal Co. Twiggar, Edward V. Other Dunkin, Neu R. Fetterman, James

SIMPSON

Other Chupeck, John

SLIPPERY ROCK

Self Employed Mitchell, Russell S.

SOUTH FORK

Other Golas, Ernest

STATE COLLEGE

U. S. Air Force McDonald, Dell V. Other Mullen, Willard F.

SUMMIT HILL

Other Kuebler, C. S.

TAMAQUA

Atlas Powder C. Simpson, Robert A. Greenwood Mining Co. Rickert, E. E. Other Marinier, J. D. A.

THOMASVILLE

omasville Stone & Lime Co. Brigstocke, Horace D.

TRUCKSVILLE

Neil, William Shepherd, Robert D.

UNIONTOWN

Republic Steel Corp public Steel Corp.
Butler, James C.
Reed, Frederick J.
S. Steel Corp.
Cook, Walter E.
Egan, Howard N.
Girod, James B.
Moore, John C.
Saari, George J.
her Other Beerbower, R. C., Jr. Snell, Wayne D. Werft, August R.

UNIVERSITY PARK

Penn. State Univ.
Berry, William F.

\*Charmbury, H. B.

\*Falkie, Thomas V.

\*Hartman, Howard L.

\*Hewes, Robert B.

Hoffman, John N.

\*Hoyt, Frank D.

Jahns, Richard H.

\*Kochanowsky. Berls. Jahns, Richard H.

"Kochanowsky, Boris J.

"Lovell, Harold L.

"Maneval, David R.

McDivitt, James F.

"Mitchell, David R.

"Osborn, E. F.

"Ridge, John D.

"Schanz, John J., Jr.

"Spicer, Theodore S.

\*Stefanko, Robert Sun, Shiou-Chuan Wright, Lauren A. Other MacHamer, Jerome F.

WAMPIIM

Medusa Portland Cement Co. Weaver, Kenneth N

WASHINGTON

Fairmont Supply Co. Cavanagh, Wm. C., Jr. Frazier-Simplex Inc. \*Frazier, John E. R. G. Johnson Co. Johnson, Stuart C. Other Hannon, J. W. G.

WAYMART

Other Schreckengost, E. D.

WEATHERLY.

Jeppsen, Harold C.

WEST CHESTER

Foote Mineral Co. Crawford, Brodie E. Mitchell, David W. Pa. Crusher Div. \*Chartraw, Harold C. Owens, David W. Other her Smith, Hubert C. Weldin, William A.

WEST MIFFLIN

Westinghouse Elec. Corp. Goetz, Lorenz J.

WEST NEWTON

Self Employed \*Brody, Albert J.

WEST PITTSTON

Mammoth Coal Co.

\*Lambert, Kenneth A.

WHEATLAND

heatland Tube Co. Leisy, R. Warren

WHITE HAVEN

Wilmot Engrg. Co. Hammonds, Haydn Hildebrand, John F. "Ippolitt, Joseph E. Jenkins, Carl S. Johnson, Harold W. Tremayne, W. Earl

WILKES-BARRE

Am. Chain & Cable Co., Inc.
Todd, Emerson H.
Glen Alden Coal Corp.
\*Bellano, William
Bradbury, Harry W.
Devens, Willis R.
Klipple, Fred L.
Swartwood, George F.
Williams, Ivor L.
Goodman Mfg. Co.
Farrell, Francis X.
Sanders, Floyd S.
Hudson Coal Co.
Rude, William J.
Lehigh Valley Coal Co.
\*Humphrey, John M., Jr.
\*Price, Thomas C.
Weatherholt, Henry S.
Fa. Dept. Mines & Mineral
Ind. Am. Chain & Cable Co., Inc.

Weathernub, ...
Fa. Dept. Mines & Mi
Ind.
\*Howell, Roger J.
U. S. Bur. of Mines
Eston, Walter L.
Self Employed
\*Eichler, Tobias
\*MacCartney, John C.
Other

Other her Everett, W. W. Farrell, Michael F. Lippi, August J. Rinehimer, E. D., Jr. Stortz, Alfred F.

WILLIAMSPORT

Other Saupp, Chauncey P.

WINDBER

Berwind-White Coal Ming. Industrial Minerals, Inc. Miller, Franklin Seese, Robert H.

WYNNEWOOD

Allen-Sherman-Hoff Pump Co. BELLE FOURCHE Allen, Homer E.

WYOMING

Cooke, Michael K. Talamelli, Velio

WYOMISSING

U. S. Bureau of Mines Ageton, Robert W.

VATESVILLE

Capone, Patrick J.

YORK

J. E. Baker Co.
Duersmith, L. J.
W. S. Frey Co.
Frey, Wm. S.
Hardinge Co., Inc.
Brown, C. Blair
Downes, H. Sidney
Hardinge, H. DeForest
\*Hardinge, Harlowe
Russell, R. J.
\*Zuercher, E. M.
Natl. Gypsum Co.

Natl. Gypsum Co.
Mensing, Henry E.
Supreme Supply Co., Inc.
Frey, John P.

Other Paul, Robert A.

ZERDE

Self Employed \*Zerbe, T. W

RHODE ISLAND

PROVIDENCE

BIF Industries

\*Milligan, W. Edward
Tower Iron Works

\*Parker, Norman H. Other

Brown, Charles W. \*Nelson, Ned E.

SOUTH CAROLINA

AIKEN

I. du Pont de Nemours & Co. Reichert, Stanley O. Godla, Joseph J.

Commercial Ores, Inc. Castle, James E Strohl, John J.

COLUMBIA

ENOREE

Zonolite Co. Hash, Lewis J.

GREENVILLE

U. S. Army Ulery, Charles R.

LANGLEY

J. M. Huber Corp. (Clay Div.)
\*Otwell, W. Larry

PACOLET

Paco Products, Inc.
Patrick, Charles W.
Powell, William H., Jr.

SPARTANBURG

Other Skardon, A. H.

YORK

Beers, Seymour J Wilson, Lewis G.

SOUTH DAKOTA

National Lead Co. Collins, R. Keith

BERESFORD

State of So. Dakota Highway Dept. Larsen, Wallace L.

CENTRAL CITY

Other Waterland, Joel K.

EDGEMONT

Mines Development Inc.
\*Webb, Harold D.

KEVSTONE

Self Employed \*Johnson, Arthur I. Other Mitchell, John W.

omestake Mining Co.
Broome, John
Campbell, William C.
Driscoll, R. E., Jr.
'DuMontelle, Paul B.
Fawkes, Fred A.
Fielder, Ronald G.
Gallo, Renaldo D.
Harder, James O.
Howell, Frank M., Jr.
'Kellar, Kenneth C.
'Kravig, Clarence N.
Lodewick, Richard B.
Mathisrud, Gordon C.
Morthland, George N.
Mosley, Fred H.
Ryan, William E.
Schmidt, Claude E.
Slaughter, Arch L.
Tarlo, Rex Homestake Mining Co. Other Gust, Cedric L.
\*Herz, Nathaniel

So. Dakota Dept. of Highways
\*Albert, Tom, Jr.
Stotelmeyer, Ronald B.

PRINGLE

Black Hills Lime Co. Kirk, Samuel A.

RAPID CITY

Black Hills Ore Research Labs.
\*Ricketts, C. E.

Labs.

\*Ricketts, C. E.
Corps of Engrs.
McCrary, R. J.
Martin Co.
Reed, Donald L.
South Dakota Cement Plant

\*Gardner, Wm. F.
So. Dak. School of Mines

\*Gries, John Paul

\*McHugh, Alexander E.

\*Oshler, Edwin H.
Partlo, Fay L.

\*Rapp, George R., Jr.

\*Smith, Ross W.

\*Tullis, Edward L.

\*Weisz, Herbert M.

\*Willigman, Melvin G.
Staven Engrg. Co.

\*Gilles, Albert P., Jr.
U. S. Bureau of Mines
Riley, James M.

Self Employed

\*Hall, Arthur E.

\*Hayes, Joel P.
Other

Hammerquist, D. W.

Hammerquist, D. W. Hill, Robert S.

SIOUX FALLS

Other Robertson, Thomas M.

SPEARFISH

Other Ross, Ed G.

VERMILLION

State Geological Survey
\*Agnew, Allen F. Other \*Rothrock, Edgar Paul

TENNESSEE

BRENTWOOD

Geologic Associates
Throckmorton, R. T., Jr.

CHATTANOOGA

Heavy Minerals Co. Kruesi, Paul R. Tenn. Valley Authori Hodgson, David L

COLUMBIA

Hooker Chemical Corp.
\*Powell, James F. Other Keller, Leonard J. Sullivan, William L.

COPPERHILL.

Tenn. Copper Co.

\*Gibson, Otis J.

Heregar, Herbert B.

Kendall, Hugh F.

Kopp, Guerdon G.

Lewis, F. Milton

Longworth, Fred J.

Sharp, Samuel E.

Weaver, Lamar

Flournoy, Ezell Wagner, Delbert R.

DUCKTOWN

Tenn. Copper Co. Annand, A. D. Clay, Roy G. Kingman, Owen Magee, Maurice Moore, Donald P.

Other Estabrooks, H. B.

ERWIN

Triclone Mines & Minerals, Ltd. \*Evans, J. Helier Other Hunter, Charles E.

FRIENDSVILLE

Self Employed
\*Sayrs, Richard L.

GLEASON

United Clay Mines Corp. Lowe, Robert D.

ISABELLA

Other Schultze, John F.

JEFFERSON CITY

New Jersey Zinc Co.
Auberry, William D.
Daugherty, Raymond
McDougal, Samuel E.
Miller, Howard W.
Provost, John F.
Redeker, Immo H.
U. S. Steel Corp.
Hustad, Philip E.
Wilson, Robert T.
Self Employed
\*Brophy, Frank B.
Other

er Jennings, Edward B. Miller, Joseph A. JOHNSON CITY

Self Employed
\*De Beck, Hubert O. KINGSPORT

Other Evans, T. B.

KNOXVILLE

American Limestone Co.
Pasco, Edwin E.
Sansom, Richard E.
American Smelting & Rei
Hollister, Victor F.
Kent, Deane F. Ref. Co. Pennsylvania-Tennessee

Pennsylvania-Tennesia
Amer. Zinc Co. of Tenn.
\*Coy, Harley A.
Langley, Melbon J.
Sanford-Day Iron Works
\*Durk, Robert R.
Jones, R. E.
\*Shevlin, George H., Jr.
\*Williams, C. H.
Gardner-Denver Co.
Franz, George A.
Ingersoil-Rand Co.
Flynn, Andrew L.
MacDuff, Richard D.
Smedman, John P.

MacDuff, Richard D.
Smedman, John P.
Joy Mfg. Co.
\*Laskevich, Stephen, Jr.
Southern Coal & Coke Co.
Pratt, E. Mahan
Volunter Port Cement Co.
Bozeman, James A.
U. S. Bureau of Mines
Lynch, Victor J.
Valley, J. L.
U. S. Geological Survey
Laurence, Robert A.
Univ. of Tenn.
\*Wiener, Leonard S.
Other

"Wiener, M. D.
Other
Moreman, Wm. D.
Pittenger, Frank H.
"Thoenen, John R.
Thompson, B. Ray
Thompson, D. A. R.
Waddock, F. B., Jr.

MASCOT

American Zinc Co. of Fenn.
\*Black, William Black, William

Bungarner, James G.
Cameron, Sidney M.
Greene, Robert F.
Miller, Harry L.
Oder, Charles R. L.
Polhemus, James H.
Ricketts, James E.
Snider, James P.

MEMPHIS

Self Employed \*Estes, Frank M. Other Miller, Roger N.

MONTEAGLE Other Edwards, Paul K.

TREADWAY

N. J. Zinc. Co. McKenzie, James B.

MORRISTOWN

Smith, Charles S.

MT. JULIET

Sprague & Henwood, Inc. Greene, John L.

MT. PLEASANT

Self Employed
\*Barr, James A. Other Derick, C. G., Jr. Girardeau, M. D.

NASHVILLE Tenn. Prod. & Chem. Corp. \*McFarlin, Carl McFarlin, C., Jr. Vanderbilt University Jewell, W. B. Other Zergiebel, C. P.

NORRIS

Self Employed
\*Pawel, George W. Other Miller, Virgil

OAK RIDGE

Union Carbide Nuclear Co.

\*Sanders, Orby Ray
U. S. Atomic Energy Comm.
Westerdahl, Allen F.

OLIVER SPRINGS

Other Shattuck, T. N.

PARIS

H. C. Spinks Clay Co., Inc. Carothers, Richard B.

### Tennessee-Texas

ROBBINS

Scott Coal Co Gallaher, Houston M.

SWEETWATER

National Lead Co., Baroid Keim, John T.

TREADWAY

The New Jersey Zinc Co.
Ashlock, Robert H.
Beattie, George J.
Blickle, Charles P.
Craig, James I.
Hill, William T.
Nelson, Jack E.
\*Zodikoff, Benjamin S.
Other Other Wright, Kenneth H.

WAVERLY

Other Mauney, Robert E.

TEXAS

ABILENE

Tesco Equipment
Collins, David L.
Self Employed
Perini, Vincent C., Jr. Other Sears, Dick

ALICE

Self Employed
\*Kline, Loren E., Jr. Other Edmonds, Bryon P.

ALPINE.

Self Employed
\*Foley, Edward J.
Pulliam, Robert N.

AMARILLO

Amer. Smelt. & Refining Co. Osen, Lars

AUSTIN

Reed & Brewer
\*Reed, Charles B.
U. of Texas
\*Flawn, Peter T. Oth Bucknall, Eric H. Crouch, Robert L. Norton, David L.

BELLAIRE

Texaco Inc. McKinlay, Philip F. Pancake, Evan

BLANKET

Other Ryan, D. P.

BRADY

Heart of Texas Mining Corp. Bruner, Foster W.

BROWNSVILLE

Other \*Nye, S. Spencer

BURNET

Southwestern Graphite Co. Miller, Robert P., Jr.

COMANCHE

Other Hatchett, Sam P.

COMMERCE

East Texas State College \*Smith, Riley S., Jr.

CORPUS CHRISTI

Amer. Smelting & Ref. Co.
Michal, Edwin B.
Consolidated Ins. Ag's.
\*Cole, James B.
Mobil Oil Co.
Morrison, John A.
Reynolds Metals Co.
Sherwin, Ralph S.

Other Hammer, William L. Paciotti, F. A.

DAINGERFIELD

Other Camp, Vernon

DALLAS

DALLAS

Allis-Chalmers Mfg. Co.

"Stahl, Harvey L.
The Atlantic Refining Co.
Klutta, Joe R.
Century Corp.
Spencer, Morris G.
William D. Crane Co.
"Graue, William D.
Delhi-Taylor Oil Corp.
Soltes, Elton D.
Esasco Services
"Kane, William G.
George A. Fuller Co.
Kalkruth, Robert A.
Geophysical Service, Inc.
Montgomery, L. E.
Saunders, Donald F.
"Thomas, James W.
Halliburton Oil Well
Wimberly, Chester L.
Hammermills, Inc.
Krage, August P.
Meredith, Meredith & Campbell
Edwards, Q. D., Jr.
Nat. Advertising Co.
Holland, Thomas H.
Natl. Data Processing Corp.
"Piana, Louis D.
Nordberg Mfg. Co.
"Daum, Eugene T.
Smallwood, Joe L.
Scoony Oil Co., Inc.
Reichertz, Paul P.
Texas Power & Lt. Co.
"Cross, Louis D.
U. S. Bureau of Mines
Evans, Arthur M.
U. S. Corp of Engrs.
Murchison, John W., Jr.
Self Employed
"Bostick, J. Wallace
"Keating, Thomas W.
"Riggs, Karl A.
Other
Bradfield, C. B.
Jennings, P. H.

Other

her Bradfield, C. B. Jennings, P. H. Lawrence, John McGarr, H. J. Murph, D. B. Renfro, Kenneth M. Watson, David L.

DENTON

Other Gray, Fred E.

DONNA

Self Employed \*Edwin, John

DUNDEE

Other Mosley, Cecil R.

EAGLE PASS

Other Ovitz, Ernest G.

EL PASO

EL PASO

Amer. Smelt. & Ref. Co.
Burt, Lester C.

"Clendenin, Thomas P.
Horle, Ariel F.
Kendall, Francis P.
"Mellen, Romney J.
Morton, Norman A.
Urquhart, James G.
Whiton, Warren W.
Border Steel Rolling Mills
"Deckrow, Theon R., Jr.
City of El Paso
Lane, Roberta P.
Darbyshire Steel Co.
Darbyshire, M. S.
Dickinson Labs., Inc.
"Dickinson, George G.
El Paso National Gas Co.
Bevan, Horace D.

El Paso National Gas C Bevan, Horace D. La Fave, V. A., Jr. Viescas, A. H. El Paso Testing Lab. Siegel, Leon H. W. Foester Foester, Hailard W. Foester, Hai L. Wilbins, Richard G. Hirsch Bros. Mchy. Co. Hirsch, Homer C.

Ingersoll-Rand Co. Danowski, T. W.

Ingersoll-Rand Co.
Danowski. T. W.
Duyker, Wolter
Head, Murray W.
Terrill, Maurice W.
Joy Mfg. Co.
Douglas, John E.
Leavell & Ponder
Buell, Lloyd T.
Mine & Smelter Supply Co.
Brady, G. T.
Phelps Dodge Ref. Co.
Misner, Howard I.
Philip Morey Co.
Morzy, Philip
Geo. S. Thomson, Co.
Enloe, Howard L.
\*Rogers, Jonathan W.
Westinghouse Elec. Corp.
Lind. Theo. R.
Texas Western College
\*McDonald, José
\*Thomas, Eugene M.
Univ. of Texas
\*Ehrlinger, Henry P.
Self Employed
\*Deisler, Paul F.
\*Ingersoll, Guy E.
\*Pyburn, Paul F.
Other
Benedict, Edwin A.

Other her
Benedict, Edwin A.
Bradish, Ames D.
Brooks, John M.
Buescher, Louis
Canales, Frank J.
Carlisle, I. Reid
Chavez, Albert B.
Chavez, Ernesto E.
Congdon, Gene E.
Davenport, James D.
Dempsey, J. P.
Derrick, Kenneth J.
Fink, William N.
Fuentes, C. A.
Garard, William J.
Godsey, Edwin S.
Goss, Eugene R.
Graham, John F.
Harper, C. S., Jr.
Jordan, Charles F., Jr.
Kennedy, Bruce W.
Lowe, John W.
Maxwell, J. Worth
McKay, Glover S.
Melancon, T. S.
Miller, Earl E.
Nash, William P.
Rule, Charles
Sproule, Barton M.
Voclezle Gustave W. Benedict, Edwin A.

Sproule, Barton M. Voelzel, Gustave W Weiner, Rudolph S. FALLS CITY

Susquehanna-Western McGill, Lewis A. Schlosser, Robert B.

FORT BLISS

U. S. Army Roberts, David

FORT HOOD

U. S. Army Canady, Donald W.

FORT WORTH

U. S. Army Engrs.

\*Dallas, Orlan L.

Self Employed

\*Dukes, William F.

\*McCart, Robert, Jr. Other Partridge, P.

FREEPORT

Dow Chemical Co. Krenzke, Fred J. \*McAnulty, William N. Sewell, Charles R. E. J. Lavino & Co. \*Vaughan, Chester D.

GARLAND

Geotechnical Corp. Heroy, William B.

GLADWATER

Other Johnson, Charles H.

GRAHAM

New Idria Mining & Chemical Co. Goring, Arthur W.

GRAND SALINE

Morton Salt Rucker, J. Ray HARLINGEN

Other Sandell Edw T. Jr.

HILLSBORO

Other Hawkins, T. G.

HOUSTON

Brown Geophys Co.
Brown, George R.
Cameron Iron Works, Inc.
Allen, Herbert
Ralph E. Davis Assoc.

"Meyer, D. W.
Duval Suiphr & Potash Co.
Morris, Wm. Page
Eagle-Picher Co.

"Fyffe, Hubert B.
Geophysical Associate, Intl.

"Steenland, Nelson C.
Hahnel, Ernest W.

"Martin, Daniel J.
Williamson, Thomas N.
Wirtz, Howard A.
Worden, Eucild Y.

"Martin, Daniel J.
Williamson, Thomas N.
Wirtz, Howard A.
Worden, Eucild E.
Efferson Lake Sulphur Co.
Lewis, Francis E.
Magnet Cove Barium Corp.
"Taibot, Charlie F.
Van Dyke, Orien W.
Miwhite Mud Sale Co.
Freeman, William G.
Van Gilder, Kerry L.
Mission Mig. Co.
King, Morton C.
Natl. Lead Co.
Baker, L. Maurice
Chaney, James B.
Elsley, Byron C.
Penrose, Reynold J.
"Pushkin, D. B.
Rowand, Reginald
Wallace, John Bruce
Williams, Don E.
Pan Amer Sulphur
Webb, Harry C.
Robert A. Ray Co.

"Pollard, Jack C.
Ray, Robert H.
Rogers Geophy, Co.

"Rogers, Sam D.
Schlumberger Well Surv.
Corp.

"Leonardon, Eugene G.
Sinclair Oil & Gas Co.
Alewine, James W.
Sohio Pet. Co.
Souders, Paul B.
Stubbs, Duerbeck & Assoc.

"Kawas, Jesus B.
Texas Gulf Sulphur Co.
Mason, Edward O.
Wolf, Albert G.
United Carbon Co.
Stanton, E. C.
United Salt Corp.

United Salt Corp.
Bonds, James V.
Self Employed
\*Arrowsmith, Murray R.
\*Bell, Olin G.
\*McEvoy, Joseph H.
\*McQueen, Henry S.
\*Schoenike, Howard G. Other

her
Berube, S. C.
Breland, Rufus A.
Davis, John M.
Foxhall, Harold B.
Hoch, T. S.
Hundley, Ovid B.
Knight, Kenneth M.
Laughery, Kent E. Laughery, Kei Lloyd, C. L. Medlock, J. D. Moehlman, Robt. S. Moos, Stanley M. Ruska, Walter E. A. Scott, Ned V., Jr. Sears, G. C.

JACKSONVILLE

Other Bishop, Norman G.

KERRVILLE

Self Employed Bevier, George M. KINGSVILLE

U. S. Navy \*Recktenwald, H. J. LAKE JACKSON

Other Cox, Vernon N.

LAREDO

National Lead Co. Archibald, John C., Jr. Self Employed Kirkpatrick, Robin R.

LOCKHART

Comstock Oil Co. Copeland, Thomas A.

LONE STAR

Lone Star Steel Co. one Star Steel Co.
Barber, Charles A.
Bonora, Martin M.
Drescher, Arthur B.
Dressner, Elliott F.
Gregory, Don M.
Malone, Vincent F.

LONGVIEW

Self Employed \*Thomas, Byron K. Other Clements, James M. Conner, Jack T. Ottman, Eric J.

McALLEN

Other Hickman, C. M.

MIDI.AND

MIDLAND
Cabot Corp.
Oppel, Richard E.
California Oil Co.
Lap, Peter O.
Humble Oil & Ref. Co.
Skalnik, Victor E.
Pan Amer. Petr. Corp.
Beek, Charles A.
The Txi Oil Corp.
McNabb, John S., Jr.
U. S. Smelt. Ref. & Min. Co.
Neuman, James V., Jr.
The Youngstown Sheet
Tube Co.
\*Flynn, Henry P.
Self Employed
Bilakemore, Page B.
Other

Other Lamkin, John L. Mauldin, Fred G. Pavlovic, Robert

NEW BRAUNFELS

U. S. Army Engrs. Corps. Wells, Alonzo M. U. S. Gypsum Co. Wheeler, Alfred H.

NEW GULF

Texas Gulf Sulphur Co. King, Glenn L. Orr, Carol L. Rainey, Dudley L. Other Siaffa, Calvin J.

ODESSA

Other Maurice, James M. Shaffer, P. D.

OVERTON

Self Employed Creekmur, Charles E.

PEARSALL

Others Pickett, G. B.

PLAINVIEW

Gibraltar Minerals
\*Reinhardt, Elmer V.

PLANO

Other Wilson, Dudley M.

SAN ANGELO

Self Employed
\*Gregory, Joseph Nalle

SAN ANTONIO

Jess McNeel, Inc.

Sullivan, Joe P.
Peerless Oil & Gas Co.
Taylor, Vernon F.
Southwest Research Inst.
Brown, Edwin A.
Curtice, David K.
Ellis, Walter H., Jr.

Liu, Tien-Shih

Mather, William B.
Self Employed
Rowden, Dale H. Rowden, Dale H.
Other
Boardman, Ray C.
Bond, Robert J.
Cuchran, R. B.
Romano, Louis C.

SAN MARCOS

Self Employed \*Pollard, John H.

SWEETWATER

U. S. Gypsum Co. Dawes, Richard E.

TEXAS CITY

Howe Sound Co. Campbell, J. B. Smith-Douglas Co. Roe, James F.

VAN HORN

Texas Highway Dept.
\*Upton, Charles B.

WELDON

Other Woods, Charles J.

WHARTON

Freeport Sulphur Co. Johnston, Robert H., Sr.

WICHITA FALLS

Other Darner, Richard R.

### UTAH

BACCHUS

Hercules Powder Co. Willey, Richard H.

BINGHAM CANYON

BINGHAM CANYON

Kennecott Copper Corp.
Anderson, W. R.

Bray, R. Eldon
Davis, Kenneth L.

Egleston, Marvin P.
Fuller, Thomas R.
Helm, John E.
Jager, Alan R.
Kerr, Dean D.
King, Frank E., Jr.
Matheson, Kenneth H., Jr.
McKellar, James L.
Olson, Emmett K., Jr.
Passavant, Charles R.
Peters, William C.
Richardson, Stanley C. Richardson, Stanley C. Smith, Wilbur H. Snow, Laurence E.

Other Johnson, C. L. Kastelic, Albert Rauer, Richard C.

BLANDING

Othe Kehoe, Charles A.

BONANZA

American Gilsonite Co. Borden, Paul E.
Dewey, Richard F.
Fessenden, Paul H.
Mealey, George A.

BOUNTIFUL

Vitro Chem. Co. Ellis, Martell T. Ellis, Martell T.
Other
Johnson, H. A.
Lee, Fred L.
Petrie, Peter B.
Sandberg, I. L.
Terry, Dale O.
York, William B.

BRIGHAM CITY

Thiokol Chem. Corp. Weatherston, Vern H.

CASTLE GATE

Independent Coal & Coke Jackson, Elias O.

CEDAR CITY

Colo. Fuel & Iron Corp. MacCannon, Robert W. Robertson, John, Jr.

Columbia Iron Mining Co.

"Hahne, Edward H.
Heyborne, Lester S.
Tompkins, F. Vernon
Urie, Roy P.
Middleton, Doug W.
McMullin, Garff K.
Pitney, Richard J.
Quinn, John D.
Utah Construction & Mining
Company

Company Bellum, Donald P. Long, Ralph J.

Other ner Bunnell, Wendel Lee Loer, Robert F. Lunt, H. D. MacDonald, G. D., III Milne, H. D.

CLEAR CREEK

Independent Coal & Coke Gordon, David G. Harvey, Stanley C. Van Wagenen, Art D.

DEVIL'S SLIDE

Ideal Cement Co. Burriss, Charles S.

DRAGERTON

Col.-Geneva Steel Div., U.S. Bowen, Ray J.
Cassano, James
Daniels, William M.
Dunham, George A.
Earnest. Howard W.
Gordon, Shefton
Goudge, Robert F.
Hammerstrom, Ralph B.
Harvey, Joseph A.
Maulsby, John T.
Moffitt, Jackson W.
McKinley, R. Edward
Olsen, Emery C.
Peternell, Frank J.
Phelps, Stanley B.
Ramey, Russell W.
Russch, Rupert
Yourston, Robert E.
Von Storch, Robert M.
Her Bowen, Ray J

Other
Clark, Leo P.
Pressett, Jack D

DUTCH JOHN

Peter Kiewit Sons Co. Savage, Loran G.
U. S. Bureau of Reclamation
Sapik, David B.

EUREKA

Bear Creek Mining Co.
Bush, John B.
Centennial Dev. Co.
Curry, David H., Jr.
\*McIntyre, E. Steele
\*Quigley, James E.
\*Spencer, Harold B.
Watt, Robert E.
Chief Cons. Mining
Fitch, Cecil A.
Fitch, Cecil A., Jr.
Kennecott Copper Corp.
Banghart, Roger C.

GARFIELD

Kennecott Copper Corp. Dennis, George

United Park City Mines Abplanalp, George H. Barnes, Marvin P. Droubay, Seth K. Gray, Arthur W.

HELPER

Carbon Fuel Co.
Diamanti, James J.
Fossat, Victor
Carbon Transfer & Supply

Odendahl, W. Thuren
\*Odendahl, Walter B.
Royal Coal Co.
Woodward, C. Ray ner Diamanti, Chris J. Vuksinick, Louis

HIAWATHA

U. S. Fuel Co. Robb, Max A. Rowley, William K.

HILL U.S. Air Force \*Pierce, S. S.

HUNTINGTON

American Fuel Hinkine, Parley, Jr.

KEARNS

Other Gillingham, W. P.

KENILWORTH

Other Guy, Walter K.

LARK

U. S. Smelt. Ref. & Min. Co. Coffey, James A. Crandall, L. Dee Lowell, Gerald F. Ogara, Henry W., Jr. Sheldon, Wright C. Tibolla, Lossoph Sheldon, Wright C Tibolla, Joseph Weagel, Robert C. Wells, Harold H. Willie, Don O. Oth

Gillam, Clyde W. Serassio, Bert, Jr.

LASAL

Other Wright, Warren E.

MAGNA

Hercules Powder Co.
Bernitz, Myron K.
Kennecott Copper Corp.
Ensign, Peter H.
Hubbard, Thomas J.
\*Mott, Clinton P.
Quigley, Charles G.
Ribotto, Joe W.
Richardson, J. W.
Walje, J. Richard
Winterowd, Burton R.
Other Other Bangs, Joseph F. Beck, Clyde

MEXICAN HAT

Texas-Zinc Minerals Corp. Apland, Kenneth C. Crouch, Gordon H. Wakefield, Roger E.

Other Von Colln, Harold M.

MIDVALE

Amco Steel & Equip.
\*Ross, Albin M.
U. S. Smelt. Ref. & Min. Co.
Greglow, Loran A.
Nelson, Archie A.
Scholl, Lester K.
Wanlass, Ralph Other

her Gillaspie, K. B. Newman, Elmer C. Stampfel, Frank J. Wright, Harold E.

MILFORD

Self Employed
\*Schoo, Henry E.

MOAB

Continental Materials Corp. Brady, Maurice H. G. P. Decker Decker, Garland P. Delhi-Taylor Oil Corp. Norman, Larry L. Norman, Robert R. Franklin Starols Co.

Norman, Larry L.
Norman, Robert R.
Franklin Supply Co.

"Yoder, Gene F.
Geological Services

"McDougaid, Wm. Dean
Hecla Mining Company
Fenske, Lloyd D.
Lindstrom, Philip
Hidden Splendor Mining Co.
Blakely, Harold W.
Craig, Samuel E.
Edwards, Albert P.
Florence, Henry S., Jr.
Fratto, Don S.
Mullen, John R.
Newman, J. Melvin
Sage, Claude L.
Homestake Mining Co.
Jacobson, Edward F., Jr.

"Miner, Gordon M.
Weid, Walter W.
Mayhew Engrs.

"Mayhew Eldon J.
Ouray Uranium Co.
Brechtel, Charles E.
Standard Metals Corp.

"Carnahan, Edward R.

\*Hurst, Robert M.

"Hurst, Robert M.
Siegfried, Frank E.
Texas Guif Sulpher Co.
Henderson, J. Frank
Kutz, Kenneth J.
Ogg, James H.
Tippie, Frank E.
Uranium Red. Co.
Hollis, Roy F.

"Izzo, Theodore F.
May, Bobby L.
McCormick, Richard E.
Olsen, Kent L.
Poppe, Daniel G.
"Ranspot, Henry W.
Simons, William H.
Unger, Richard W.
Utex Exploration Co.
Barrett, Theodore J.
Bilyeu, Virgil A.
Blake, Robert A.
Kundert, Karl H.
Pierson, Max D.
Steen, Charles A.
Other
Davis, Vernon C.

Steen, Charles A.
Other
Davis, Vernon C.
Franklin, William J.
Jones, Rex L.
Karayan, C. A.
Loring, W. B.
Melich, Mitchell
Rowe, Carl H.
Smith, Rupert M.
Walker, Glen

MONTICELLO

U. S. Atomic Energy Comm. \*Hoffman, John E. Other Palmer, Jerald

MURRAY

Gladding, McBean & Co. Stevens, Joseph E. United Technical Ind. Trover, W. Morris \*White, Merwin G. Self Employed \*Belt, Charles B., Jr. Other Beck, Russell R. Hansen, Walter R Nelson, Robert D

Pospisal, Dean H.

OGDEN

Lion Coal Corp.

Batchelor, DeLyle
U. S. Forest Service
Dow, Vernon T. Other Fay, H. M. Jordan, Marcus C.

OREN

Bickford, K. F. Chapman, Roger H. Peper, R. K. Sigman, V. L.

PARK CITY

New Park Mining Co.

\*Archer, Bob F.

Muth, James V.

Keigley Quarry Johnson, Raymond C.

PRICE

Dinosaur Service, Inc.

Axeigard, Walter T.
Hartman & Jensen
Jensen, Robert Lee
Spring Canyon Coal Co.
Hileman, Douglas H.
Standard of California
Leavitt, Jackson K.
Other Other Fratto, Anthony J. Jensen, Ralph C. Wadleigh, Dwight W. Watkins, G. R.

PROVO

Columbia-Geneva Steel Div., Columbia-Geneva Steel Div.,
U.S. Steel
Evans, Howard
Grandy, George Arthur
McMorris, William L., III
Williams, Milton F.
Columbia Iron Mining Co.
Camp Leslie W.
Hayes, John K.
"Humphrey, Arthur G.
Mark, Glifford A.

\*Moore, Lyman \*Reiff, John J. Seklemian, Robert Other Bullock, Kenneth C.

RAINS VIA HELPER

Western Coal Mining Co. Schultz, H. J.

ST. GEORGE

Intermountain Exploration Co.
\*Wyman, Richard V. Other Poehlmann, Edw. J.

SALT LAKE CITY

Aero Service Corp.
Lee, Herbert P.
American Cyanamid Co.
Brown, Otto R.
\*McKenna, LeRoy
American Gilsonite Co.
Henderson, John H., Jr.
American Smelt. & Ref. Co.
DiSanto, Bartel J.
Frost, James Frank
Lacy, Robert J.
Ness, Arnold W.
Newman, Earshel W.
Schelck, Edmund H.
Weiss, Norman
Amer. Zinc, Lead & Smelt.
Co.

Amer. Zinc, Lead & Smer Co. Mills, Hiram F. Anaconda Co. \*Dwyer, Robert G. Garmee, Walter J. \*Hansen, Leon A. Knostman, Richard W. Mulchay, Roland B. \*Thompson, Mercer F. \*Wardlaw, Frank A., Jr. Armco Steel Corp., Sheffield Div.

Armco Steel Corp., Sheffi Div. Bailey, Frank E. Atlas Equipt. Co. Walker, James M. Austan Corp. \*MacGinniss, John Bares Construction Corp. \*Bares, L. J. Bear Creek Mining Co. Anderson, James A.

Bear Creek Mining Co.
Anderson, James A.
Bailly, Paul A.
Billingsley, Paul
Cook, Douglas R.
Eisenbrey, Edward H.
Rose, Arthur W.
Beryllium Resources, Inc.
\*Leisek, Joseph F.
Black & Deason
Deason, B. W.
B.L.M. Utah State Office
Mudgett, Philip B.
Honneville Ltd.
Hadzeriga, Pablo
Macdonald, Robert D.
Booth Co., Inc.

Macdonaid, Robert D.
Booth Co., Inc.
Booth, Lionel E.
Clitheroe, Jay B.
Boyles Bros. Drilling Co.
Chesler, Peter
Durfee, Richard F. Goldsworthy, Arthur F. Goldsworthy, Arthur F. Goldsworthy, Robert T. 'Guard, Alton K. Haddon, Edwin D. 'Smith, Wilford D. 'Stevens, Victor L.

"Stevens, Victor L.
Callaman Mining Corp.
Baker, Arthur, III
Chicago Bridge & Iron Co.
Schultz, Jack W.
Christensen Diamond Prod.
Augustson, Anders E.
"Harris, William I.
Miles, Ned
J. J. Coan Co., Inc.
Coan, Byron G.
Columbia-Geneva Steel Div

Columbia-Geneva Steel Div.,

U.S. Steel Div.,
U.S. Steel Brimley, Heber C.
Combined Metals Red. Co.
Lee, Reginald G.
Snyder, Edward H.
"Young, Earl B.
Comm. Shear. & Stamping

Co.
\*McBirnie, Carl L. R. \*McBirnie, Carl L. H. Eimco Corp. \*Bernard, Lynn D. Dowdey, Wayne L. Finch, Graham G. Grames, Lloyd M. Kipp, Ewald Kirschner, Ernesto J. \*Richter, Paul O.

Utah-Virginia

\*Thompson, Robert B.
West, Edmund G.
Galigher Co.
Anderson, C. Milton
Evans, Shirley L.
Huch, Richard O.
\*Lange, Lawrence H.
Gardner-Denver Co.
Andrews, Irving W., Jr.
Jarvis, D. G.
General Electric Co.
Blakley, R. Thomas
Hohmann, Harold E.
Geo. Engrs., inc.
\*Aldous, T. Melvin
J. M. Grisley Machine Tools
Grisley, Robert J.
Heiner Coal Co.
\*Heiner, Claude P.
Hercules Powder Co.
Hearon, Henry Hooper
Hewiti-Robins, Inc.
Speaker, Francis B.
Hidden Spiendor Min. Co.
\*Brittan, Richard L.
Christie, Russell L.
Christie, Russell L.
\*Christie, Russell L.
\*Dwyer Ed. T.
Hayes, Dale Irwin
Perkins, James C.
Poller, Harry S.
Wood, Edwin T.
Independent Coal & Coke Co.
Newberry, Donald J.
Industrial Physics & Electronics Co.
\*Marquardt, C. M.
Ingersoll-Rand C.
\*Ingersoll-Rand C.
\*Ingersoll-Rand C.
\*Ingersoll-Rand C.
\*Ingersoll-Rand C.
\*Ingersoll-Rand C. Utah-Virginia

Industrial Physics & Ele
tronics Co.

\*Marquardt, C. M.
Ingersoll-Rand Co.
Merritt, Joseph B.
Moore, Wesley J.
Intl. Smelting & Refing Co.

\*Burt, Glen A.
J. T. Jenkins Co.

\*Susper, Mark T.
Joy Mig. Co.
Davis, Logan E.
Swiler, William R.
Kennecott Copper Corp.
Bader, John W.
Baldee, Lorenzo
Barlow, V. S.

\*Bogden, Grey
\*Brown, Henry J., Jr.
Burt, Wayne H.
DesRosier, Charles D.
Engelmann, Edward W.
Erickson, John D.
Gough, Ray F.
Green, Frederick C.
James, Allan H.
Lagergren, M. A.

\*MacDonald, David B.
McLonald, David B.
McLonald, David B.
McLonald, David B.
McLonald, Donald J.
McDonald, David B.
McSel, George M.
Meyer, Robert E.
Michaelson, Stanley D.
Nichols, John W.
O'Keefe, John P.
Rausch, Donald O.
Rees, Thomas B.
Roberts, Frank C.
Seery, Major W.
Slothower, Ben H.
Soderberg, Adolph
Thuli, Alvin J., Jr.

\*Westphal, Mario S.
Wood, Lewis C.
Kennecott Research Center
Fraser, George L.
Smith, Francis J.

\*von Stein, Paul
Zimmerley, Stuart R.
Kumhla Exploration Co.

\*Davis, Dudley L.
Link-Belt Co.
Newsome, Donald W.
Lottridge-Thomas & Assoc.

\*Thomas, Leonard G.
Machinery Center Inc.
Anderson, Donald O.

\*Lehner, Kenneth A.
Uzelac, Joe G.

Marvel Mining Co.

Harrison, Duncan E.
Matsie Co.
Saunders, David W.

Matsie Co.
Saunders, David W.
Saunders, David W.
Mich.-Utah Cons. Mines Co.
\*Van Evera, DeWitt
Minerec Corp.
\*Banta, Royden J. Mine Safety Appliances Co. Allen, Earl W. Mt. States Rubber Co. Inc. "Scofield, Glen J.

Mt. Wheeler Mines, Inc. Williams, James D. Natl. Equipment Co. Cannon, Wilford S. Ingalls, Robert B. Merry, Henry M. Nati. Filter Media Corp.

\*Haedt, Robert V.
New Park Mining Co.

\*Hansen, Gale A.
Wiese, Robert G., Jr.

Nuca Co.

\*Hall, Newton L.

\*Hall, Newton L.

Park City Cons. Mines Co.

\*Stehle, Frederick T.

Peterson, Fleters & Engrg. Co.

Peterson, C. Lynn

\*Peterson, Larry G.

J. Price Assoc. Co.

\*Price, John

Quigley & Hendel

\*Quigley, W. Don

The Rains Co.

\*Rains, Phillip K.

Rare Metals Corp.

\*Hansen, Leland A.

Kline, Mitchell H.

Lomas, R. E.

Reynolds, John R.

Runke, Sidney M.

Rocky Mountain Machy. Co.

Buehler, F. Lloyd

St. Regis Paper Co.

Willett, Alfred A.

Senior & Senior

\*Senior, Clair M.

Shenon, & Full

\*Full, Roy P.

\*Nagell, Raymond H.

\*Shenon, Philip J.

C. H. Spencer & Co.

Bathran, Roger O.

Standard Oli of Calif.

Kleinkopf, M. Dean

Star Dust Mines, Inc.

Battey, Leslie J.

State of Utah

\*Holmes, John W.

Techmanix Corp.

Poormon, D. E.

\*Snyder, Edward H., Jr.

Tintic Standard Min. Co.

Paine, Milton D.

F. C. Torkelson Co.

Huff, Ira S.

\*Torkelson, Frank C.

Union Assay Office, Inc.

Sedier J. V.

Huff, Ira S.

\*Torkelson, Frank C.
Union Assay Office, Inc.
Sadler, J. V.
Wanlass, Walter C.
U. S. Bur. of Land Mgmt.
Koch, Walter H.
U. S. Bureau of Mines
Clemmer, J. Bruce
Everett, Floyd D.
Nichols Ivan L.
Pike, Jullan A.
Pilmpton, H. Gilbert
Wilson, Stephen R.
U. S. Geol. Survey
Hilpert, Lowell S.
McCann, Harvey E.
U. S. Smelt. Ref. & Min. Co.
Ashurkoff, Boris
Barber, C. J.
\*Boyd, Benton
Conrow, John M.
Ehrhorn, Jack M.
Gerwels, Richard P.
Glaeser, Oscar A.
\*Thornburg, Chauncey L.
Univ. of Utah
\*Cook, Kenneth L.
\*Eardley, Armand J.
\*Fisher, Donald G.
\*Fitzgerald, James D.
Kerr, Halbert S.
Mgilaccio, Robert H.
\*Nackowski, M. P.
\*Stringham, Bronson
\*Wadsworth, Milton E.
\*Whelan, James A.
\*Willson, John E.
Uranium Reduction Co.
Losse, John W., Jr.
Utah Chostruction & Mining
Rackley, Ruffin I.
Utah Lime & Stone
Flatberg, Orrison M.
Utah Mining Association
Horne, Walter M.
Romney, Miles P.
Utah Power & Light Co.
Mulcock, Wayne F.
Utah Power & Light Co.
\*Barkley, Byron F.
Vitro Chem. Co.
\*Vitro Chem. Co.

Vitro Chem. Co. Moore, James D. \*Schiff, Norman N. Vitro Minerals Corp. Young, Gavin H. Western Machinery Co. \*Smith, Scott L.

\*Smith, Scott L.
Western Powder Co.
Gibson, Edgar G.
Western Rock Bit Mig. Co.
Hawkesworth, Maurice W.
Siegel, Horace U.
Westinghouse Electric Corp.
\*Hodgins, H. B.
Jones, J. N.
Lacher, Karl K.
Weyher Const. Co.
Weyher, Robert F.

Wilson Exploration Co.

\*Wilson, Clyde H.

Self Employed

\*Baker, John H.

\*Baker, John H.
\*Beeson, Joseph J.
\*Boutwell, John M.
\*Breckon, L. S.
\*Chettle, E. V.
\*Clarke, Roger W.
\*DuBois, Max M.
\*Ferris, Lockwood W.
\*Flint, Arthur E.
\*Gardner, Percy S.
\*Hanson, Frederick W.
\*Hewitt, William P.
\*Hunt, Richard N.
\*Jenike, Andrew W.

Hewitt, William F.
Hunt, Richard N.
Jenike, Andrew W.
Johnson, Earl S.
Johnson, J. Fred
Landenberger, J. C., Jr.
Mallinekrodt, Philip A.
Oldright, George L.
Osmond, John C.
Osterstock, Robert W.
Plerce, Roger V.
Plerce, Roger V.
Requa, Lawrence K.
Tuck, Ralph
Walker, Harlan A.
Witter, George G., Jr.
ther

Other Adair, Donald H. her Adair, Donald H. Alderman, S. S., Jr. Allison, Bill Anderson, E. L. Anderson, Royal P. Arentz, S. S., Jr. Austin, Charles, S. Jr. Barker, Thomas, Jr. Barrett, Soren A. Beckstead, Rex C. Beers, Armond H. Blessing, Ernest Bole, J. A. Burwell, Blair T. Bush, Giles F. Carlson, T. R. Chaffin, C. E. Christiansen, F. W.

Carison, T. R.
Chaffin, C. E.
Christensen, F. W.
Christensen, A. L.
Christensen, N. S.
Clark, Robert B.
Clemmons, B. H.
Cranmer, Wm. H. H.
Cropper, K. F.
Dawson, Harmel A.
Dempster, Anthony G.
Dugan, John F.
Dyer, Bert W.
Earl, George C.
Eilers, K. Fritz
Ensign, Horace A.
Frinch, Robert R.
Friendly, O. N.
Gibbons, John P.
Granger, Arthur E.

Gibbons, John P.
Granger, Arthur E.
Griffith, W. A.
Gunnel, Farrest V.
Hanna, Ernest V.
Harrison, Thos. R.
Hays, Larry J.
Heitzman, Mearle G.
Henline, Cloyd H.
Herres, Otto
Hersey, Lewis G.
Hilton, Chas. C.
Hinckley, S. B.
Hood, Karl K.
Hoskins, J. R.

Minckley, S. B.
Hood, Karl K.
Hookins, J. R.
Houghton, G. K., Jr.
Hubbard, S. Jackson
Hughes, David E.
Ivers, J.
Ive

Plummer, Neil Portmess, Robt. R.

Price, Robert W. Rains, L. F. Ray, Otto A. Roberts, Gwilyn E. Root, Robert L. Rosenblatt, Joseph Root, Robert L.
Rosenblatt, Joseph
Sharp, William
Shields, Paul L.
Shilling, Jacob D.
Smith, Cecil H.
Snyder, David M.
Sontum, Christian
Sorensen, Paul M.
Sparf, C. R.
Stanley, Norman
Starr, Robert P.
Stewart, Richard L.
Taylor, Gordon P.
Thomas, O. F.
Vander Veer, H. J.
Ware, William C.
Weiss, Alfred
Westerberg, Carl S.
Wetzel, N. F.
Williams, John F.
Williams, Robert I.
Williams, Robert I.
Williams, Robert I.
Williams, D. David
Wolter, Jack W.
Wormald, Bruce
Wright, Theo R.
Zimmer, Peter F.

SANDY

Other Haug, L. J. SUNNYSIDE

Kaiser Steel Corp.
Farnsworth, Gial A.
Huntsman, Lynn P.
Hyatt, Vincent
\*Maki, Julius W.
Peperakis, John
Taylor, Joe T.

Other McCourt, Thomas R. Tallerico, Nick Wright, Wilmer C.

Internalt. Smeit. & Ref. Co.
Kostello, George V.
McKenna, William J.
Steinbach, Emill W.
McFarland & Hullinger
Erickson, Kenneth L.
Hullinger, Sidney R.
Utah Calcium Products Co.
Townsend, Pyron E.
Other

her Cunard, Frederick House, O. E. Karlsten, Ralph C. McAllister, Edgar O. Perkes, E. S. Tate, I. A. Var

WATTIS

Lion Coal Corp. McAlpine, Earl H.

WELLINGTON

Columbia-Geneva Steel Div., U.S. Steel Pressett, Eugene Knight Ideal Coal Carlson, C. Arthur

VERMONT

BARRE

Rock of Ages Corp.
Ferris, Cyrus Y., Jr.
Gillette, Robert S.
The Wells-Lamson Quarry Co.
\*Wall, E. Frank

BELLOWS FALLS

Foote Mineral Co. \*Eldon, William A. C.

BRISTOL

Vermont Kaolin Corp. Mould, Willis P. Thurber, Richard B.

BURLINGTON

Eastern Magnesia Talc Co., Inc.

Bleser, Philip De F.
Esckilsen, Emil E.
Magnus, W. W.
Umont Mining Inc.
Evans, Lewis P., Jr.

DORSET

Self Employed Dickey, George Daman

NORWICH

Farmers Lime Co., Inc. \*Dwelley, Richard C. Other Benson, Clarence B.

PUTNEY

Parini Corp. Rape, Sylvester H.

WATERBURY

Other Backels, Victor A.

VIRGINIA

ALEXANDRIA

Beers & Young
\*Beers, Roland F.

Other Gowen, Justin B. Reilly, James P. Watkins, Vernon L.

AMHERST

Other Brand, R. C.

ANNANDALE

\*Ryan Christopher W.

ARLINGTON

Self-Employed

\*Gardner, Eugene D.

\*Grimes, John Alden
\*Porter, Samuel J.

her Anderson, Walter C. Burgess, Dwight S. Chandler, Henry P. Harrington, Daniel Holderer, George B. Murdock, Thomas G. Schrecengost, H. A. Tully, C. W. Other

AUSTINVILLE

The New Jersey Zinc Co.
Brown, W. Horatio
Canada, John B.
Chaffee, Maurice A.
Gallagher, Robert T., I.
Hanan, William S., Jr.
Knutson, Ray M.
McNaughton, Clark H.
Morgenstern, Carl G.
Paulson, Walter H.
Tripucka, Paul
Vannoy, James L.
Other Other Frankenfield, Wm. D.

REAVERDAM

Metal & Thermit Corp.
\*Goin, Charles M.

BERRYVILLE

Other Williams, J. P., Jr.

BIG STONE GAP

Stonega Coke & Coal Co.

\*Muron, Phillip K., Jr.
Schott, W. C.
Smith, W. Clifford
Strang, E. N.
General Coal Co.
Shupe, James N.

BLACKSBURG

Virginia Polytechnic Inst. Foreman, William E. \*Holland, Charles T. \*Shelton, Carl, Jr. Other Cooper, Byron N.

BLUEFIELD

Other Pero, J. W.

BLUEMONT

Agnew, Wing G.

BRISTOL

Enterprise Wheel & Car Corp.
\*Lahr, Robert W.

CASTLEWOOD

Atlas Powder Co. \*Carty, William J.

CENTREVILLE

Other Stull. Chas Meade

CHARLOTTESVILLE

Virginia Division of Mineral esources Calver, James L. Hopkins, Henry

Chase, Albert H.
\*McGill, William M.

DANTE

Clinchfield Coal Co.

\*Corriveau, Martial P.
Hughes, Robert H.
Joslin, Richard E.
Morris, Francis M.

\*Stapleton, William A.
Tieche, Chas. K.

DELAPLANE

Other

Tyssowski, John

DUFFIELD

Foote Mineral Co. Cooke, Walter E. Kneass George B., Jr.

FALLS CHURCH

Melparo, Inc.
Lindberg, Russell A.
U. S. Bureau of Mines
Nahai, Lotfollah
Self Employed
\*Wysor, Rufus J. Other Mackintosh, R. M.

FT. BELVOIR

Engr. Research & Development Labs.
Hogan, Daniel J., Jr.
U.S. Army
Bock, Arlen R.
\*Bunn, Clinton O.
\*Greenwood, Henry V.

U.S. Gypsum Co.
Decker, H. D.
Connett, Robert P.
POCAHONTAS
POCAHONTAS
Copeland, Alfred E

FREDERICKSBURG

Other Newman, S. M., Jr.

FRONT ROYAL

Scholla, Paul F. GAINESVILLE

Other \*Ristedt, Ernest J.

GALAX

Allied Chem. Corp
\*Nichols, James O.
Gossan Mines-Gen. Chem.
Div.
Green, William R.

GRUNDY

Feds Creek Coal Co., Inc.

\*Venable, Robert V. Other ner Hawkins, P. Lester, Edsel H.

HAMPTON

Other \*Martin, J. Dickerson

IVANHOE

Other Huddle, Chas. R.

JEWELL RIDGE

Jewell Ridge Coal Corp. Kilgore, William D., Jr.

KIMBALLTON

National Gypsum Co. McDonald, Roderick G. Lekowski, C. Steven

Standard Lime & Cement Tilmont, Carl C.

I PESBIIRO

Developmental Engineering Corp. orp. Parker, Pierre E.

LEXINGTON

Washington & Lee Univ. Sargeant, Leonard, III

American Geological Institute
\*Stephenson. Robert C.
U. S. Bureau of Mines
Ryan, J. Patrick

MARTINSVILLE

J. A. Gustin & Assoc.
\*Gustin, J. A.

MIDDLEBURG

Self Employed
\*Wells, Thomas L.

MILLWOOD

Athlone, Inc.
\*Dunning, Archibald R.

NEWPORT NEWS

Union Carbide Ore Co. Battle, Fred P.

NORFOLK

Southern Materials Co. Llewellyn, Clement M.

NORTON

Other Malesky, Joseph S.

PINEY RIVER

Amer. Cyanamid Co. Craven, Carrol E.

PLASTERCO

Pocahontas Fuel Co.
Copeland, Alfred E.
Ferretti, Peter P.
Fowler, Cleon R.
Luther, Roland C. Porterfield, C. W. Skewes, William J. Oth

POUND

Other Bolling, Clarence C.

RICHMOND

Chesapeake & Ohio Railroad

Co.
Ritchie, George G.
Lone Star Cement Corp.
Fritta, Stewart S.
Massey Coal Mining Co.
Massey, E. Morgan
Reynolds Metal Co.
Baumgardner, L. H.
Hollett, Grant T.
Michell, Wilson D.
Moorgan Henry D. Michell, Wilson D.
Moorman, Henry D.
Moses, John H.
Neathery, Thornton L.
Rice, Walter L.
Wimpfen, Sheldon P.
Solite Corporation
Castleberry, Douglas
Roberts, John Watts
Sydnor Pump & Well Co.,
Inc.

Inc. Hockman, Edwin L. Farrell, Andrew A.

\*Henrichs, Charles E.

Other Forester, Max H.

ROANOKE

Norfolk & Western R.R. Broadhurst, Sam D. \*Prosser, Fred Kell The Roanoke Corp. \*Brown, Samuel T.

ROCKY MOUNT

Other Kite, James W.

ROYAL CITY

Other Robertson, Franklin

ST. CHARLES

Other Connelly, C. F.

ST. PAUL

Other Sutherland, W. H.

SALTVILLE

Olin-Mathieson Chem. Corp. Holt, John L. \*Rapp, H. Clinton Shepard, Ralph E. Weaver, Robert S.

STEPHENS CITY

M. J. Grove Lime Co. Bass, Charles E.

STEPHENSON

J. W. Burress, Inc. \*Ellers, Thomas as E.

STRASBURG

Chemstone Corp. Falvey, Arthur E.

SUNBRIGHT

Other McDonell, A. J.

TAZEWELL

Jewell Ridge Coal Corp.
Alley, Marvin L.
Bagenstose, Raymond M.
Cothern, Leland I.
McBurney, Eugene E.

TIMBERVILLE

Tri-State Zinc, Inc. Hayes, Larry G.

WAYNESBORO

Gen. Electric Co.
\*Reinhard, Fred P.

WICE

Thompson & Litton
\*Litton, John W., Jr.
\*Thompson, Wm. A., Jr.

WOODBRIDGE

Other Barton, Wm. R., Jr. WYTHEVILLE

Other Albers, Walter L.

WASHINGTON

BELLEVUE

Other Rice, William L. BELLINGHAM

Permanente Cement Co.
\*Hollenbaugh, Kenneth M.

BOTHELL

Geo-Recon, Inc.

\*Schwarz, Sigmund D.
Self Employed

\*Peters, Chester M. F. Other Harrison, James R. Wadsworth, Dean

BUCKLEY

Cameron A. Rich Assoc.

BURIEN

Other Languess, Oren O.

CHELAN

Self Employed Phillips, Wellington S.

CHEWELAN

N. W. Magnesite Co. Endrice, Barney Fisk, Roger L. Ziebell, Howard A. Lovejoy Mining & Leasing Lovejoy, Victor E.

CLARKSTON

Other Atkinson, Sheridan K.

COLVILLE

Amer. Smelt. & Refin. Co. Paparich, Frank M. Goldfields Cons. Mines Co. Swan, Willis A., Sr.

Mod. Home Builders Inc. \*Gonnason, Walter L.

FORD

Dawn Mining Co.
\*Darlington, William H.
Payne, Keith E.
Pike, James A.
\*Stucker, Paul E.
Newmont Exploration
McCue, James O.

FORT LEWIS

Other Schierman, Gerald L.

FRIDAY HARBOR

Self Employed \*Green, Stephen H.

KENNEWICK

Calif. Spray Chem. Co.
\*Rosene, Carl John Other Thomlinson, J. R.

LIBERTY LAKE

Other Eklund, Dalhart R.

LOPEZ

Other Banks, Robert T.

MAPLE FALLS

Permanente Cement Co.

\*Wilson, Glen B.

MARSHALL

Self Employed \*Oriard, Lewis L.

MERCER ISLAND

Self Employed

\*Haaland, Otto E.

\*Hammond, Paul E. Other Strandberg, T. R.

METALINE FALLS Amer. Zinc & Lead & Smelt.

\*Shellenberger, Floyd H.
Lehigh Portland Com. Co.
Clayton, Austin B.
Pend Oreille Mines & Met.
Co.

\*Crampton, Jack C.

\*Kinney, Lindsay M.

MONROE Other Knudsen, Frede

MORTON

Beck, Sidney E.

MUKILTEO

Self Employed
\*Melrose, John W. OLYMPIA

Wash. Dept. of Highways McLaughlin, Tony W. Wash. Div. Min. & Geol. Huntting, Marshall T. Bennett, W. A. G. Ford, Donald M.

OYSTERVILLE

Other Thompson, Glenn L.

PORT BLAKELEY

Other Earling, Roy B. PULLMAN

Wash. State Univ.
\*Burns, Robert Donald
\*Cavin, Richard E.
Culver, Harold E.
\*Jaekel, John A.
\*Masson, Donald L.

Virginia-Washington

PUVALLUP

Other Hammermeister, E. A. Judy, John W.

RENTON

Boeing Airplane Co. Dingle, Julius J. Gladding, McBean & Co. Clark, Raiph I. \*Holmes, David A.

REPUBLIC

Knob Hill Mines Inc. Patterson, Allan R. Self Employed \*Houghland, Everett P.

RICHLAND

Gen. Elec. Co.

\*Brown, Randall E.

\*Cote, Ralph W.

Wick, O. J.

SEATTLE

Alluvial Golds, Inc.

\*Patty, Ernest N.
Atlas Powder Co.
Barnes, John G.
Easterly, Emmett G.
Nichols, John R.
Boeing Airplane Co.
Beckwith, Aifred T.
Crial, Richard S.
Didrichsen, Wm. G.
Dolch, Edward W.
Hood, Don W.
Hyatt, Milo J.

\*Lightfoot, William E.
Richard, Kermit W.
Slover, Frederick R.
Corps of Engr.
Richards, John C.
E. I. du Pont de Nemours &
Co., Inc.
Inc. General G.
Strohecker, S. M., Jr.
Evans Engine & Equip. Co.
Oman, Edward G.
Gladding, McBean & Co.
Roberts, John T.
Goodnews Bay Min. Co.
Vinnedge, Robert W., Jr.
Great No. R'way Co.
Haley, Alva J.

\*Watson, Ralph A.
Wollenzien, Thomas P.
Hemphill Bros. Inc.
Hemphill Bros. I

West Coast Engineering, Inc. \*O'Brien, Robert D.

U. S. Bur. of Mines Geer, Max R. Magill, Elwin A. Popoff, Constantine C. Sokaski, Michael

U. S. Army \*Reed, Jack C. U. S. Coast Guard Winter, Roger L.

U. S. Navy Noring, Harold A.

# Washington-West Virginia

Self Employed
\*Bissett, David H.
\*Douglass, William C. Bissett, David H.
Douglass, William C
Krukar, Milan
Roberts, Milnor
Romig, Woodfred E. Other

Atomig, Woodred E. her Boyd, Glen A., Jr. Burns, John S. Clark, Richard W. Davidson, Haroid O. Jacobsen, Gordon L. Kniseley, John M. Krom, Joe F. McGuire, Louis H. Meals, John E. Nevin, N. M. Rice, Ronald E. Richelsen, Walter A. Williams, Lewie Wimmler, Norman L. Yancey, H. F.

### SPANAWAY

Other Corp, Ernest L.

# SPOKANE

Alis-Chalmers Mfg. Co.
Nesbeitt, W. D.
Amer. Cyanamid Co.
Moyer, Samuel P.
Anaconda Co.
Miliam M.
Stephens, Edward C.
Atlas Copco Pac. Inc.
Milner, Carlos E., Jr.
Bear Creek Min. Co.
"Goddard, Charles C., III
Hutchinson, Robert D.
Lutz, Norman R.
Bethlehem Steel Co.
Shrauger, M. Pete
Birch Co.
"Birch, Frank E.
Gardner-Denver Co.
"Ringel, James E.
Grandview Mines
"Anderson, Eskil
H. Halvorson, Inc.
"Roby, Robert Neil
Hecla Mng. Co.
Harper, Herbert E.
Quinlan, James J.
Hercules Powder Co.
Harper, Herbert E.
Quinlan, James J.
Hercules Powder Co.
Longtin, Garth A.
R. S. McClintock Co.
Irwin, Philip H.
Metaline Mining & Leasing
Co. & Grandview Mines
Barnes, Edwin K.
Jasper, Karl W.
Mines Management Inc.
"Green, W. Randolph
Nat'l Equipment Co.
Walters, William M.
Pend Oreille Mines & Met.
Jensen, Jens
Zeigler, W. L.
Sheep Creek Mines. Ltd.

Pend Oreille Mines & Met.
Jensen, Jens
Zeigler, W. L.
Sheep Creek Mines, Ltd.
Marr, Frank N.
W. H. Stowell & Co.
Stowell, William Henry
Sunshine Min. Co.
Edgar, John
Elstone, Earl F.
Hardy, Robert M.
Osborne, Nathan J.
The Wash, Water Power Co.
Martin, Armor B.
U. S. A. E. C.
King, David P.
U. S. Bureau of Land Management
"McBroom Harmor B.

U. S. Bureau of Land Management

\*McBroom, Horace R.

\*Nelson, William
\*Ryman, Michael E.

U. S. Bureau of Mines
Anderson, Webster S.
Appling, R. N., Jr.
Holt, Dean C.
Hubbard, Charles R.
Krempasky, George T.
Pattee, Eldon C.
Rodriguez, Ernest R.
Service, Alfred L.

\*Waddell, Galen G.
West, John M.
U. S. Geol. Survey
Weissenborn, Albert E.
J. Fred Williams & Assoc.

\*Williams, J. Fred, Jr.
Winterspoon, Kelley

Winterspoon, Kelley Neff, John L.

ner Burbidge, Frederick Burrows, Lees J., Jr. Chadwick, Russ H. W.

Chichester, L. G., Jr. Dolman, Phillips B. Garrett, Samuel K. Green, William R. Haffner, J. B. Holt, Robert E. Holt, Robert E.
Hunter, James H.
Jones, Paul L.
Klobusicky, T.
\*Larson, Roy H.
Marsh, Jamie F.
Masters, Edw. S.
Oscarson, P. E.
Turk, Thomas W.
Van Noy, Ronald M.
Weldin, Robert D.

TACOMA

TACOMA
Amer. Smelt. & Refin. Co.
Anderson, Kenneth H.
Krisman, Emil M.
Leonard, W. C.
Somerville, David A.
Bennetts Chem. Lab. Inc.
Maddess, M. S.
City of Tacoma
"Huber, Thomas N.
Robinson & Roberts
"Fryberger, John S.
Tacoma Assay & Test., Lab.
"Jeklin, Lewis E.
Self Employed
"Benson, Faul T.
"Gillis, Julius Howells
Other

Gillis, Julius Howel
Other
Bowman, Robert A.
Fowler, Howard M.
Gordon, Harold F.
Jackson, R. O.
Thomsen, Denton

USK Other Fisher, Joseph

VANCOUVER

\*Aluminum Co. of America Beetem, David Howard \*Cappa, Francis X. The Carborundum Co. \*Anderson, John R. Other carroll, H. J. O. Dilworth, J. B. Lawson, Paul F.

WALLA WALLA Aaaland-Hoskins Assoc \*Hoskins, Charles B.

U. S. Army Corps of Engi-\*Ames, Marshall B. Knox, James W.

WELLPINIT

Isbell Constr. Co. Krupp, Luther Metz

WENATCHEE

Lovitt Min. Co. Inc.
Lovitt, Edward Hill
Thompson, Oscar D.
Wash. State H'way Dept.
Lee, John P.
Self Employed
\*Welch, John R.

YAKIMA

Self Employed \*Oswin, Richard B.

YARDLEY

Gibson & Roberts, Inc. Langston, Albert Edgar

WEST VIRGINIA

ASHLAND

Ashland Min. Corp. Oster, Howard S.

BARRACKVILLE

Bethlehem Mines Corp. Kolwey, Herman G. Lebo, Daniel E., Jr.

BARRETT

Other Reedy, Donald M.

BARTLEY

Island Creek Coal Co. Strunk, Thurston H.

BECKLEY

Gates Engrg. Co.

\*Gates, Leslie C.

\*Mallette, Reese E. Hogue, Andrew O. B. McCutchen, Dan Putman, L. T. BERKELEY SPRINGS

Penna. Glass Sand Corp. Toewe, E. Clayton

BLUEFIELD

Allied Chemical
Gillie, Percy H.
American Cyanamid
\*Featherstone, George J.
Ashland Coal & Coke Co.
Walker, William W.
Daniels Co.
\*Daniels, Herman J.
Benyer, Enginment Co.

\*Daniels, Herman J.
Denver Equipment Co.
\*Beardsley, Conrad T. E.
Georgia-Pacific Corp.
Glover, Charles L.
Melayne Pocahontas Coal
Workman, M. L.
Pocahontas Land Corp.
Graham, William R.
Crickmer, Douglas F.
Other

Other Lazer, Benjamin Warden, Henry F.

BUCKHANNON Peck's Run Coal Co. Williams, Frank E. Other Tokarczyk, Stanley

CANNELTON

Cannelton Coal Co Morton, Paul

CARBON

Carbon Fuel Co. Thomas, Lewis N., Jr.

CEREDO

Oglebay Norton Co. \*Bishop, Jack M.

CHARLESTON

Amherst Coal Co.
Hopkins, A. S. J.
Jones, Herbert E., Jr.
Carbon Fuel Co.
Thomas L. Newton
Commercial Test & Engrg.

Co.

\*Lindsay, Kenneth E.

Crab Orchard Coal & Land

\*Linussy, \*Linussy, \*Linussy, \*Crab Orchard Coal & Land Co.
Co.
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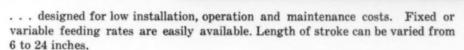
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Stanrock Uranium Mines Ltd.
Hales, F. William

Jones, F. Raymond Kettleson, Harold Other Schultz, Wm. G. Zaremba, Tadeusz

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Finlay, James E.
Fraser, John H.
Healy, Edward L.
Rivett, Louis S.
Weglo, John K.

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Other Cook, Forrest M.

# FORT WILLIAM

Other Kustra, Clarence R.

### GALT

Joy Mfg. Co. (Canada) Ltd. Ross, David W. M.

GUELPH Canadian Gypsum Co., Ltd. Cox, Bart

HAGERSVILLE

# Other McGrath, Clifford

HAILEYBURY Prov. Inst. of Mining Atchison, Daniel W.

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Dom. Foundries & Steel Co. Loosley, Frederick A. Steel Co. of Canada Ltd. Chisholm, Jack T.

# HOLTYRE

Ross Mine Caylor, R. D.

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\*Wigle, George P. Other Elliott, Robert A.

# JAMESTOWN

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# KASHABOWIE

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# KINGSTON

Aluminium Lab., Ltd. Hay, Robert H. Other Corlett, A. V.

# KIRKLAND LAKE

Heath & Sherwood Drilling & Chem. Grouting Ltd.
McBean, J. W. Other Hotchkin, M. W.

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Lakefield Research Ltd. Allen, Jules P. Hubler, W. G. Other Douglas, Geo. M.

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Other Wagner, Robert F.

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Madsen Red Lake Gold Mines, \*Crayston, Edmund G. Van Loon, L. H.

# MANITOUWADGE

Geco Mines Ltd. Jokisch, C. R. \*Marshall, G. Merle T.

Waterland, T. M. Other Lanchester, F.

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### MCKENZIE ISLAND

McKenzie Red Lake Gold Young, Horace G.

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# NEW LISKEARD

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Canadian Longyear, Ltd.
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\*Reimers, Jan H. Other Keefe, John A. C. MacLeod, John McLachlan, Charles G. Reilingh, Albert

Falconbridge Nickel Mines, Makarinsky, Frank M. McQuitty, Stan

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Hayalip, Gordon O.
Ignatieff, Alexis
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Reeves, John E.
\*Sirois, Louis L.
Smith, Harold Wm.
Woodrooffe, H. M.
Carleton Univ.
\*Riddell, John E.
Defence Construction Ltd. \*Riddell, John E.
Defence Construction Ltd.
Kelly, Terence A.
Eldorado Ming. & Ref., Ltd.
Barrett, Richard E.
\*Thunaes, Arvid
Meredith & Finlayson
Finlayson, Donald G.
N. J. Zinc Expl. Co. (Canada)
Ltd. Goranson, Edwin A.
M. J. O'Brien, Ltd.
Scott, Alan
Quebec Metallurgical Ind. \*Davis, Norman B.
Stratmat Ltd.
Monture, Gilbert C.
Self Employed
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\*Spence, Hugh S.

# Other Frechette, Howells Morrison, Robert P. Wyman, R. A. PAMOUR

Pamour Porcupine Mines, SWASTIKA Honsberger, J. A.

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aconda Co. (Canada) Ltd. Boerner, Alfred E. Brinley, Edward H.

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Knaebel, John B.
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Riedel, Robert W.
Other Other Emmerson, E. Roy

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\*Everard, Franklin Joseph

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Parr, Theo M.
Canadian Nickel Co., Ltd.
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I. C. Christopher, Ltd.
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Denver Equip. Co. Can., Ltd.
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Dome Mines, Ltd.
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Porritt, Richard V.
Northern Miner
Carrington, J. W.
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"Cavanagh, R. L.
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"McParland, Donald J.
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"Ross, Alvin H.
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"Simard, Lionel R.
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"Powelson, J. M.
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A. Gamble, Terry S.
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Cox, Geoffrey A.
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"Ross, Henry U.
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"Sloan, Douglas A.
Ventures, Ltd.
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\*Sharpstone, David C.
\*Stewart, C. H. E.
\*Tamplin, Morgan J.
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\*Willlams, R. Massey

\*Williams, R. Massey \*Wilson, Basil T.

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Smith, Van H. Wansbrough, V. C.

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Fredeen, Sture R.
Hawkes, George J.
Yule, S. C.

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W. G. Wahl, Ltd.

"Wahl, William George
Seif Employed

"Bjarnason, Bjarni S.
"Bronson, Edwin H.

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\*Lavigne, Mervyn

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Canadian Johns-Manville Co., td.
Borror, Chas. D.
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Conn, H. M. Keith
Lindell, Karl V.
Straw, David John

Other
Baker, R. D.
Eby, J. O.
Monroe, David L.

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Lake Asbestos of Que., Ltd. Edwards, Thomas R. Messel, Michael J. Piuze, Lionel Charles

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# BROWNSBURG

n. Safety Fuse Co., Ltd. Chalmers, John B.

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Walker, Arnold M
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Wilkle, Raymond E.
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# GARDENVALE

Canadian Mining Journal \*Mamen, Christen

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Canadian Refractories, Ltd. Bray, Wm. T. Grant, Harold G.

# KNOB LAKE

Iron Ore Co. of Canada Nelder, John E.

# LENNOXVILLE

Other Burbank, H. A.

# Canada-Mexico

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New Hosco Mines, Ltd Hosking, William J.

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Aluminium Laboratories, Ltd.
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Patience, L. Patrick
Walker, W. J. K.
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Weigel, Melvin Powell
Aluminium Secretariat, Ltd.
Harder, F. Arctic Inst. of North America
"Reed, John Calvin
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Canada Cement Co., Ltd.
Hamilton, V. C.
Canadian Bechtel Co., Ltd.
"Way, Gordon L.
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"Ponesse, Thomas J.
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Morrison, Bernard H. Ltd.
Morrison, Bernard H.

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Canadian Inst. of Mining &
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Pitt, Norman P.
Cons. Mining & Smelting Co.
of Canada, Ltd.
Yates, Edward M.
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Moss, Frank A.
Cyanamid of Canada
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Dominion Brake Shoe Co.,
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Nelson, John Edward
Stevens, Robt. William
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Fairley, Albert L., Jr.
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Ecole Polytechnique
"Carbonneau, Côme L.
Hewitt Equip., Ltd.
Mills, Gordon B.
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Weldon, Frederic

Timmins, Leo n.

N. A. Timmins, Lid.
Weldon, Frederic
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Brosseau, Pierre
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'Greenaway, N. J., Jr.
Johnston, L. E.
Wilkinson Linatex Co.
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Self Employed
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\*Ames, H. Lyall

Quemont Mining Corp., Ltd.

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Dworatzek, Joachim J.
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Quebec Columbium, Ltd. Bond, Stephen B.

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Other Boyko, W. P.

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Que. Cartier Mining Co. Grosz, Roland W. Huff, Virgil R. Patterson, Lewis J. Peterson, Jerome J. Severson, Lloyd J. Oth Coombes, W. K.

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Canadian Carborundum Co. Hawn, A. Conrad

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Hilton Mines, Ltd. Halupka, H. A. Tyler, Edwin R.

Que. Iron & Titanium Corp. Noy, Jack M.

# THETFORD MINES

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Bladon, Leigh W.
Bright, James H.
Foster, William H.
Jenkins, George F.

Penhale, A. L.
Ross, James Gordon
Smith, John M.
Thurston, Frank E.
Warren, Clayton E.
Canadian Industries, Ltd.
Michaud, J. Marcel
Johnsons Co., Ltd.
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\*Livingstone, David A. Other Dumont, G. H.

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Aluminium Co. of Canada, Ltd. Gnaedinger, John B.

# WESTMOUNT

Other Vissac, G. A.

# SASKATCHEWAN

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Eldorado Mining & Ref., Ltd.

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Marshall, Kneale T.
Pittson, Victor J.
Woodward, Jack R.

# ESTERHAZY

Other Lane, Robert H.

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Gunnar Mining, Ltd. Stevens, Donald C.

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Alwinsal Potash of Can., Ltd. Goudie, Marion A. Sask. Dept. Min. Res. Kents, Paul

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# YUKON TERRITORY

Yukon Cons. Gold Corp., Ltd. McFarland, Warren H. S.

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Bond, Elbert T.
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Cia. Minera de Guazapares
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\*Lindenau, E. M.
Cia. Utah, S.A.
Terry, Richard L.
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Bishopp, Eugene D.
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PARRAL Cia. Minera Asarco, S.A. Buddecke, Donald B. Byrd, Robert C. Evans, Thomas A.

Other Brown, Philip Taylor, R. B.

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# SANTA BARBARA

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\*Ruiz, Julio O. Other

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"Llamas, Raymundo C.
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Guerrier, Eduardo G.
Peña, Salvador S.
"Terrazas, Alfredo
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Penoles Mining Co.
Roel, Faustino P.
Perforadora Latina, S.A.
"Gaines, Richard V.
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Gonzales-Reyna, Jenaro
Stephens-Adamson de Mex.
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"Garcia, José Agustin
'Vaupell, C. W.
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"Booth, Daniel M., Sr.
"Perez, Francisco, Jr.
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Cortes-Obregon, S.
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Fernandez, Mario
Gandara-G., J. J.
Guzman-Carreon, I.
Himmelstine, Carlos
Llamas, Raymundo C.
Madero, Antonio
Madero, Antonio
Madero, Enrique
McCarthy, John C.
Morales, Javier E.
Nevin, Thomas H.
Nieto, Jorge C.
Reyes-Soto, Pedro
Rhodes, W. B.
Romero-Luna, F.
Schiele, Wm. R.
Shedwick, V. J., T.
Tapia T., Roberto
Terrones L., A. J.
Trevino, S. F.
Uiloa, S.
Vinegra, F. O.

# DURANGO

DINAMITA Cia. Minera de Explosives, S.A. Chavez, Oscar H.

DURANGO Other Reyes, J. M. S.

GUANACEVI Cia. Minera el Trebol, S.A. Behrens, R. Howard

SANTA MARIA DEL ORO

Other Neumann, G. W.

# TAYOLTITA San Luis Mining Co. Benham, Willard M. Morel, Lawrence F. Morel, Robert C. \*Pattison, H. C. Richardson, Peter W. Williams, Stanley E.

# GUERRERO

GUANAJUATO Other Sproat, A. D.

# TAXCO

Cia. Minera Asarco, S.A. Foster, Earl Franklin Kipnis, Morman Robles, Manuel A.

# JALISCO

AJIJIC Other \*Mitchell, George W.

GUADALAJARA Purisima, S.A.

\*Adams, Malcolm M.
Swecomex, S.A.

\*Hughes, Herbert V.

Other Madero, Enrique, Jr. Wasteneys, G. M. Whishaw, Quentin G.

MASCOTA Self Employed
\*Matusiewicz, Andrew

MEXICO

TOLUCA Other Jarvis, Royal P.

MORELOS

CUERNAVACA Sopris, Robley Freeman Woodul, J. R.

NUEVO LEON

MONTERREY
Cia. Minera de Penoles, S.A.
Haas, Maurice C.
Sanchez-Mejorada, Pedro
'Taylor, C. Mack
Welsh, Michael James
Williams, C. T.
Cia. Minera Nuevo Leon, S.A.
Jacob, Leonard, J.
Prado, Jose J.
Fundidora de Fierroy
"Villamar, Salvador V.
Las Encinas, S.A.
Camelo G., Felipe
Minquim Internacionales
Colen, Henry R.
Self Employed
"Salisbury, Earl F.
"Triplett, Walter H.
Other
Garcia, O. S. MONTERREY

ner Garcia, O. S. Jauregui, Luis A. Lopez-Barrera, A. Sauza, Javier

SAN LUIS POTOSI

CERRITOS Neg. Mra. de Azufre, S.A. Zironi, Francis V.

CHARCAS Cia. Minera Asarco, S.A. Clark, William G. Ehrlinger, Henry P., III Maese, Arthur J. Pickard, Greenleaf W., Jr.

MATEHUALA Neg. Mra. Sta. Maria de la Paz °Garate-Naudin, Victor

SAN LUIS POTOSI Cia. Minera las Cuevas Almazan, C. Minerales Pennsalt, S.A. de C.V. \*Cutting, P. J.

RIOVERDE

Cia. Minera Rio Colorado \*Johnson, Fred Elon

SINOLA

COSALA Cia. Minera Asarco, S.A. Amis, Cecil Rhodes Slessinger, Leonard J. Wilhelmi, Fred A.

SONORA

ALAMOS Minas Quintera, S.A. Lambert, Donald P.

CABORCA Carlota Copper Co. & Agricola de Son. \*Alexander, John L.

CANANEA

Cia. Minera de Cananea, S.A. de C.V. e C.V.
Cooper, James R.
Cooper, James R.
Donohoe, C. P.
Fenn, A. J.
Fuller, Edward P., Jr.
Loving, John C.
'Mendelsohn, Albert
Montijo, H., Fernando
Morris, George E.
Stern, Roger
Tye, William H.
Weed, Robert C.
Wells, James T.

GUAYMAS Grafitera de Sonora, S.A. de C.V. \*Hammond, A. Horton

HERMOSILLO Minas de Guatamo, S.
\*Lynch, H. Grattan Other G.-Quintanilla, F. L.

MAGDALENA Self Employed
\*Fields, Howard H.

MORENO Cia. Minera de San José, S.A. de C.V. \*Lord, William D., Jr.

NACOZARI Minerales America, S.A. Williams, Ben F. Montezuma Copper Co. Ramos, Miguel O.

SAN JAVIER Minas de San Javier, S.A.
\*Pitzel, Louis D.

TAMAULIPAS CUIDAD VICTORIA Other Rodriquez, F. H.

VERA CRUZ

COATZACOALCOS Cia. Explor. del Istmo, S.A. Bustos, Guillermo A. Other Brooke, Chase J., Jr.

JALTIPAN Pan-American Sulphur Co. Semrad, Robert

MINATITLAN Westinghouse Electric Co. of Mex. Fellencer, C. A.

ZACATECAS

AVALOS Cia. Minera de Penoles Peck, DeWitt C., Jr. McCabe, Robert P. Savage, John P. Self Employed \*Manderfield, Edward A.

FRESNILLO FRESNILLO
Fresnillo Co., The
Anderson, Richard C.
Bailey, Fred W.
Carswell, John M.
\*Meyer, Robert L.
Schou, Hans H.
Stone, John B.
Veale, C. O.
von Ziegler, Frederick G.

SOMBRERETTE Minera San Martin, S.A. Chico V., Enrique Kohls, Albert E.

> CENTRAL AMERICA COSTA RICA

SAN JOSE SAN JOSE
Alcoa de Costa Rica
Stouffer, Harold W.
Wright, Thomas L.
Aluminum Co. America
Colegrove, Willard J.
Embajada de Holanda
Zyderveld, Pieter H.
Food Industries, Inc.
\*Strong, Philip K.

GUATEMALA GUATEMALA CITY

Cia. Minera de Guatemala Probert, Alan Intl. R.R. of Central Amer. Crowe, E. W. Other
Delaitre, Pierre C.
Tufts, John M., Jr.

HONDURAS JARAL Honduras

New York & Hond Rosario Min. Co. Emdin, Harry J. Morris, William Pierce Robinson, Harold R. Stott, George F.

**NICARAGUA** 

BONANZA Neptune Gold Mining Co. Aguirre, Luis H. Burton, Robert S. Corcoran, T. A., Jr. Schuring, Henry G.

MANAGUA MANAGUA
Cia. Minera la India
Spencer, Donald N.
La Luz Mines, Ltd.
Kentish, Norman
Neptune Gold Ming. Co.
Eimon, Paul I.
McCullough, W. Stuart
Rosita Mines, Ltd. Galloway, Walter F. Hopper, Ronald V. Servicio Geologico Nac. \*Tito, Lagana

RIO COCO Mina Santa Rosa Andersson, T. M.

PANAMA CANAL ZONE BALBOA HEIGHTS

Panama Canal Co.

\*Hurtado, Julio E
Stewart, Robert CURUNDU

Other McDaniel, Duane B.

WEST INDIES CUBA

HAVANA HAVANA
Banco Nacional de Cuba
Moron, Francisco
Compania Minera Buenavista
\*Montoulieu, Eduardo I.
Instituto Cubane Mineria
I.C.M.
\*Salinas, Rafael Mariño
Observatorio de Belen
Goberna, Joseph Raphael
Other Other

ner Castro, Carlos Ruiz-Williams, E. J. Vidal, F. F. DOMINICAN REPUBLIC BARAHONA

Bestwall Gypsum Internl. Merriss, Philip R. CIUDAD TRUJILLO

Alcoa Exploration Co. Moreno, Francisco Wrobbel, Fred C.

BRITISH WEST INDIES BARBADOS

Other Ong, John N.

JAMAICA

EWARTON Alumina Jamaica, Ltd. Lillicrap, D. H.

KINGSTON Alcoa Minerals of Jamaica,

Alcoa Minerals of Jamaica, Inc.
Inc.
Inc.
Moritz, John A.
Alum. Co. of America
Lampert, John W.
Caribbean Cement Co., Ltd.
\*Osler, Richard L.
\*Yarberry, Lee M.
Dept. of Mines
Rickman, Edmund Gerard
\*Spence, Reginald E.
International Metals, Ltd.
Perelli, Richard J.

KIRKVINE P. O. Alumina Jamaica, Ltd. Frost, F. E.

LYDFORD Reynolds Jamaica Mines Harris, C. Gordon

ST. ANN Reynolds Jamaica Mines Cole, Wm. S., Jr. Williams, Richard R.

SPUR TREE Kaiser Bauxite Co. Clary, John H. Lallman, M. W. \*Phillips, Charles S. Timberlake, R. C. Tretzel, Donald C.

PUERTO RICO

RIO PIEDRAS Other Cribbs, Richard E.

SAN JUAN Self Employed
\*St. Clair, John Q. LARES

Bear Creek Mining Co. Aguilar, Gustavo Reynoso R., Rigoberto

VIRGIN ISLANDS ST. THOMAS Reddy-Rock, Inc. Russell, Thomas F. Self Employed \*McKim, James

NETHERLANDS ANTILLES,

NEWPORT Mijnmaatschappij Curacao Heywood, Tom T.

> SOUTH AMERICA ARGENTINA

BUENOS AIRES Banco Industrial \*Conti, Luis Banco Industrial

\*Conti, Luis

G. Breuer Co.

\*Guerrico, Martin

Cabot Argentina

Hall, Arthur L.

Compania Minera Aguilar

\*Lew, Wing Leong

Ingersoil-Rand Co.

\*Cunningham, Peter J.

Minerals y Metals S.A.I.C.

Tolderlund, Otto

National Lead Co.

Bryan, G. Gregory

Worcester, John

Sominar Soc. Minera

Burnett, Bruce R.

Williams, Thomas J.

Univ. of Buenos Aires

\*Stelf Employed

\*Perichon, Luis A.

\*Wieklinski, Stefan

Other

Other

her Acevdo, Arturo Beard, R. R. Ellinger, Enrique Mesigos, Marcelo G. Pelaez, Raul V. Vila, Fernando

CIUDAD DE SALTA Other Reguera-Azcuenaga, J.

CORDOBA Other De Ferari, Ciro P. ROSARIO

Other Werner, Hans R. SAN HIAN

Mina Castano Viejo Emidy, Theodore E. Other Bates, Ramon Ruiz Leidhold, Helmut

SAN LUIS Facultad de Ciencias \*Rossi, Ernesto E.

TRES CRUCES Cia. Minera Aguilar, S.A. Brady, Bernard F. Cropper, Wallace J. Miller, Clinton L. \*Rossetti, Marco J. Steele, Robert

BOLIVIA BOGOTA

Cia. de Cemento Portland \*Mewhirter, Sydney A. CATAVI

Empresa Minera Catavi Alandia B., Julio Victoria Mill Antezana, Carlos J.

COCHABAMA Bolivan Gulf Oil

Coughlin, Robert E.
Emp. Minera Santa Maria Ltd.
\*Holme, Percy E.

LA PAZ Corp. Minera De Bolivia \*Saravia, Augusto M. Embas Ltd.

Embas Ltd.
\*Sarmiento, Marco E.
International Mining Co.
Heard, H. T.
Mina Chojila
Campusano S., German
South Amer. Placers, Inc.
Lusney, John E.
Self Employed
Broersma, Goosen
\*Zubrzycki, Piotr P.
Other

Other \*Nogales, Luis A.

ORURO

Empresa Minera Co. Kooyman, J. Minera de Bolivia Corp. Davila, Oscar M.

Mexico-British Guiana

Other Solis, Nicolas

POTOSI

Emusa Dorado, Waldo Reyes

BRAZIL

ABAYA Mineracao Wah Chang Cole, James Wayne

BELEM ICOMI Seara, Antonio C.
Indust. e Comerico de Min.
Appel, Luíz E.
Petrobas
Roberts, Walter D.

BELO HORIZONTE Exploração de Minerios Bar-Bell, Enfield B.

Other Alcorn, J. P. CURRAIS NOVAS Mineracao Wah Char Miskulin, Mike G Other

Gardner, Geo. D. Pimentel, Victor J. DORUMBA

Other Knowles, D. P. NOVA TIMA Min. Morro Velho, S.A. Kochersperger, Donald Pereira, Neuclayr M. St. John Del Rey Min. Co. Callaghan, Eugene Other

Other Nogueira, Jose F. RAPOSOS Est. de Bondes Min. Hanna Co. Penido, Guido D.

RIO DE JANEIRO Banco de Brasil Souza, H. C. Alves de Cia. De Mineracao Novali-

mense
Dulles, John W. F.
Cia. Denen. de Ind. Minerais
Claus, Richard J.
Cia. Meridional de Mineracao
Russell, Charles B.
Ind. e Com. de Min., S.A.
Butler, Robert D.
Kenranda Pesquisas Min. S.A.
Hartman, Louis W.
Mibraco

Mibraco

\*Marshall, William R.
Univ. of Brazil
Campbell, Donald F.
Self Employed

\*Brown, Emerson I.
\*Pinagel, Hubert A.
Other Other Erickson, Eugene P. Fleming, R. C. Sydenstricker, D. G.

SALVADOR Curso de Geologia Mahrholz, Wolfgang W. Mattoso, S. de Q. Other

Humphrey, Fred L.

SAO PAULO

Dorr-Oliver (Brazil) Ltd.
Mourier-Petersen, P. A. F.
Dow Corning Inter.
Goldmann, Theodore B.
Kaiser Aluminio do Brasil
Walker, Walter S.
A. Industrias Votorantim
"Moraes, Jose Ermirio
Other. Other her Figueirede, E. D. Jafet, Roberto N. Loeb, Michel J. Martinelli, Jose A. Passos-Guimaraes, J.

BRITISH GUIANA

GEORGETOWN Demerara Bauxite Co., Ltd. Campbell, James G. Reynolds Metals Co. Bartlett, Charles E.

MACKENZIE Demerara Bauxite Co., Ltd. Georgi, Henry M.

### Chile-Peru

CHILE

# ANTOFAGASTA

Anglo-Lautaro Nitrate Corp. Anglo-Lautaro Nitrate Corp Spencer, Cyril L. Strong, Charles N. Empresa Minera de Mantos Dawidowicz, S. Kohler, Theodor H. 'Meckel, Walter F. Nuysink, Arie J. Reijnst, Bernard A. Vince, P. M. Empresa Nacional de Min. 'Escalera, Marcelo C.

# CHUQUICAMATA

Chile Exploration Co. Allen, Joseph C. Becker, Robert C. Biegman, K. A. Bruna, Horacio A. Biegman, K. A.
Bruna, Horacio A.
Delaney, John F.
Forsman, Donald M.
Grenier, Arthur G.
Hamilton, Robert L.
Hedges, Brian F.
Heitman, Ralph E.
Henderson, Harry B.
Hodges, Paul A.
Hunter, Lorne H.
Laurich, Robert MacDonald, Robert A.
Marcus, Jerrold J.
Mayer, Franz L.
"Monje, Enrique R.
Payne, Richard F.
Price, Jas. H.
Rahausen, Gonzalo C.
Sanders, David
Swift, Robert G.
Teel, Joel H.
Vallez, Michael H.
Witcomb, E. W.
Wyman, Glen S.
ther Oth Randall, Robert

# CONCEPCION

Sutulov, Alexander Waissbluth, Greg

Sali Hochschild, S.A. \*Cossoro, Moll Carlos

# EL SALVADOR

Andes Copper Mining Co.

\*Cole, Allan A.
Hansen, Barry J.
Leonard, Charles B.
Parker, Greg V.

# IGUIQUE

Other Hoffman, David J.

# LA SERENA

Bethlehem Chile Iron Mines Krumm, R. R. Petersen, Edmund F., Jr.

# POTRERILLOS

Andes Copper Mining Co.
Astlett, Harry A.
Bates, William A.
Delzo, J. R.
Fines, Leonard O.
Hendrickson, Ian D.
Hoobsbawn, Peter B.
Pollish, Lloyd
Robbins, Harold E.
Trafton, Berl A.
Wendt, Walter

# QUILPUE

Other Crichton, Juan E.

# RANCAGUA

Braden Copper Co.
Babson, Thomas J.
Birch, Robert M.
Eisner, Thomas M.
Gadberry, James W.
Grant, Byron E.
Jarrett, Stanley M.
Jeffers, Alba W.
Jigins, Reginald, W.
Mattson, Ralph S.
Miller, Robert M.
Thornton, F. R.
Other Oth

Aguirre, Enrique

### SAN FELIPE

Jimenez, E. Hagel

### SANTIAGO

Braden Copper Co.
Haldeman, Robert M.
Cerro Corp.
Kyburz, Edward P.
Renzetti, Bert L.
Cla. Amer. Smelting, S.A.
Brown, Wendell T.
Wise, Francis A.
Cia. Anonima Cuprifera de

Sagasca
\*Gray, Edmund M. R.
Cia. de Acero del Pacifico, S.A.

\*Gondenneau, Pablo
Cia. Minera Sta. Fe.
Bacon, Robert C.
Cia. Minera Y. Comercial
Benitez, Fernando
Hochschild, Sali
Cia. Sud. Amer. de Evnlor

Hochschild, Sali
Cia. Sud. Amer. de Explosives
Echalar, Alberto V.
Sobral, Daniel M.
Fabrica Nacl. de Carburo
Echeverria, Vicente
Ingersol-Rand Co. Fleming, Charles W.
Joy Intrni., S.A.
Williams, Melvin E.
UN Spec. Fund Mineral Sur-

Dahlstrom, Elis M. U. S. Geological Survey \*Carter, Wm. Douglas

Other Arancibis, Nemesio R. Bosio V., Guido Bramson, Bernard A. Goldmann, L.
Judson, W. R.
MacKenna, F. Cuevas
McLaughlin, J. F.
Swain, Robert L.
Van Dorp, J. F.

### VALLENAR

Comp. de Acero del Pacifico Aiken, George E.

# COLOMBIA

BOGOTA Chivor Emerald Min., Inc. Chivor Emerald Min., Inc.

\*Bronkie, Willis F.

Joy Inst., S.A.

Fritz, Glenn H.

Metalurgica Grancolombiana

\*Prieto, Joaquin

Texas Petr. Co.

Robbins, Raymond K. Aisenberg, Victor I. Carter, Harold C.

Cia. Minera Choco Pacifico. S.A.
Azzaretti, Frank J.
Burke, Michael A.
Rumpf, Vincent G.
Soma, John L.
Geoperfo, Ltda.
\*Francken, Robert B.
Servinel.

# Servipol \*Smith, V. Courtlandt, II EL BAGRE

Pato Cons. Gold Dredg., Ltd. Barraza, O. Benj. J.

EL CENTRO

rest Colombian Corp. Douglass, Fred D.

# MEDELLIN

Felix de Bedout e Hijos de Bedout, Dario ther Geale, George J. Hill, George B. Posada, Juan de Lac \*vom Staufen, Hubert

# OTU

Frontino Gold Mines, Ltd.

\*Aldous, Philip Kenyon
Baker, John F. Camposano, Gustavo Lubienski, Boris McPhee, Roland Merwin, Roland W. O'Donnell, Keith

# SANTA MARTA

United Fruit Co. \*Lane, Emerson C.

### SEGOVIA

Frontino Gold Mines, Ltd. Bonoli, Felipe Friderici, Alex A.

### ECUADOR

### GUAYAGUIL

Escuela Politechnica Navarro, W. F. Camacho

### PERU

# AREQUIPA

Compania de Minas del Peru. Hermann, Juan Bernardo Other Goodman, Lyle O., Jr. Juilland, P. G. Williams, A. Howell

### CASAPALCA

Cerro de Pasco Corp. Bosweil, Paul F. \*Galvan, Carlos C. Lavin, J. W.

# CERRO DE PASCO

Cerro De Pasco Corp. Bayko, John H. Chevez, J. Diaz Forbes, J. McLaren Fretz, Ray C. Germundson, James Germundson, James W
Kristjanson, Harold G.
Lees, William G.
Melrose, Thomas G.
Oxley, David
Rother, Eberhard
Russell, Dalton L.
Selters, John J.
Toelle, Harry A.
"Trevejo, Carlos Misael
Cia. Minera Atacocha
\*Bautista, Felipe
\*Portaro U., Pedro

# CHUQUIBAMBILLA

Other Billwiller, C. J.

# HUANCAYO

Minas Cercapuquio, S.A. Chaman V., Francisco Florez, G. P.

# LA OROYA

Cerro de Pasco Corp.
Bemis, Reginald Sherman
Clarke, C. Dixon
Gerbracht, Fred P.
Flores C., J. E.
Harris, L.
\*Hollett, Allen B.
Hood, S. R. R.
Kelly, H. Allen
Lehto, Robert S.
Mitton, J. Gary
Phendler, Roy W.
Roggero, Carlos E.
Saunders, Bill G. Saunders, Bill G. Scott, D. Wood, William G.

# LIMA

Cook, Wilbur John
Administradora de Minas
Bernstein, Merwin
\*Fleischman, C. L.
\*Rosenshine, Leon James
Armco Peruana, S. A.
Cumpston, G. S. W.
Atlas Copco Peruana, S. A.
Ohman, Lars E.
Philpott, W. P.
Banco Minero del Peru
Stens, Alfredo G.
\*Tassico, Narciso
Boza Alrcorbe Hermanos
Boza, Hector J. Boza, Hector J.
Capitana Gold Mines Co.
Manchuris M., A.
Castrovirreyna Metal Min. Co.
Lewis, Rachal H.

Cerro de Pasco Corp.
Barrios, A. H.
King, Norman E.
Kuryla, Michael A.
Moser, H. J. (Peter)
Smith, Julian Dexter
Cia. de Minas Buenaventura
Benauldes, Alberto
Vidal, Elmer Jesus
Cia. de Minas del Peru, S.A.
Hamilton, Bertram J.
Cia. Minera Huampar, S.A.
del Aquila, J. Herman
de Mola, C. T. Loret
Cia. Minera Palca, S.A.
"Samame, Mario B.
Cia. Minera Tarica, S.A.
Erquiaga, Ruben
Cia. Minerales Santander, Inc.
Beynon, Arthur F.
Randall, Frank M.
Cie. des Mines de Huaron
Garrigue, Pierre Louis
Consorico Minero del Peru
"Tapia, Carlos Rigoberto
Custer & Thommen

Custer & Thommen
\*Kamm, Chas. R.
Cyanamid Inter-Amer. Corp. Hartjens, Herman John Deere Intercontinent Carver, John M. Diamantina B. H. Boyles

\*Boza, Jorge H.
\*Sanchez, Leo T.
Dow Chemical Inter.
\*Holme, R. Norman
Exportadora Peruana

Exportadora Peruana
Ferreyros, Ernesto H.
Fernandini Mines
Fernandini C., E.
Gardner-Denver Co.
"Gordillo, Guillermo
Gov. of Bolivia & United Na-

Gov. of Boutlook

Ayza, Juan

Grace y Cia. (Peru)

"Alverez Calderon R., G.

Kantorowicz, Rolf F.

"Kent, George G.

Inca Mining & Development
Co.

"As Clarence Lee

"As Clarence Lee

Dempsty,

MOROCOCHA

"Allen, K. L.

Bailey, Donald H.

Schenk, James C.

Inca amount of the control of the co

Del Carpio, A. Z.
Joy Manufacturing Co., S.A.
Coats, S. Floyd, Jr.
Moore, Perley L.
Kennecott Copper Corp.
Towsiey, Fred E.
Marcona Mining Co.
Bartlett, Howard F.
Cabrera, Victor R.
Carwin, J. Ralph
Craig, Glenn E.
Englund, John O.
"Gay, Sylvester P., Jr.
Hoyt, John W.
"Kohn, Russel F.
Legault, Raymond Z.
Matherly, Arthur G.
Salberg, Richard I.
Seymour, Oliver G.

Matherly, Arthur G.
Salberg, Richard I.
Seymour, Oliver G.
Vandel, Galien T.
Waring, David L.
Mauricio Hochschild y Cia.
Joseph, Werner O.
\*Knobler, Richard R.
\*Wendel, Clifford A.
Mine Safety App. Co.
Hutchinson, William C.
National Univ. of Engineering
\*Sotillo, Cesar
Nippon, Mining Co.
Kubo, Hidemasa
Northern Peru Mining Co.
Canning, Brian P.
Entwistle, Lawson P.
Germeraad, Johannes
Williams, Albert B.
Pan American Commodities
Bradley, Daniel A.
Peruvian Gulf Oil Co.
Keppel, David
C. H. Plenge Ore Test Lab

Keppel, David
C. H. Plenge Ore Test Lab.
Plenge, C. H.
Refractorias Perunanos, S.A.
McCracken, William H.

McCracken, William H San Luis Gold Mines Co. Thomas, Romilly C. Servicios Petroleros, S.A. Parfet, Staniey W. Soc. Minas de Huacchara "Zuniga, Emilio

Soc. Min. Puquio Cocha Brazzini, Alberto E. Southern Peru Copper Corp. Immonen, L. G. Johnson, Kenneth R. Rodriguez, Daniel M. S.P.I.S.A. \*Dym, Koert A. Standard of Quality Group \*Young, Wallace U. S. Bureau of Mines Spencer, Richard N. U. S. Steel Export Co.

U. S. Steel Export Co.
Riordan, John F.
Utah Co. of America
Arguedas, Jose A.
Utex Exploration Co.
Haynes, John F.
Vulcan Mines Co.
Russell, Clyde R.
Wells Overseas, Ltd.
Graadt van Roggen, Fred
McHarg, Norman S.
Self Employed
\*Othick, Richard J.
\*Rose, Erwin
Other

her Alfaro, Carlos O. Avery, Don Baertl, Ernesto A. Barrantes-Garate, E. T. Belon, Enrique T. Benedict, Ralph F. Bilstein, Gunter J. Birkbeck, J. M. Chian, Augusto Daly, Robert E. Daman, Arthur C., Jr. De Las Casas, F. B. Olsen, Albert G. Other Olsen Albert G. Olsen, Albert G.
Portaro, Edgardo
\*Reilly, John G.
Rizo-Patron, A. R.
Rojas, Thomas E.
Sotomarino, C. A.
Stevenson, Frank B.
Tarnawiecki, A. S.
Trego, H. E.
Venegas, Aguiles F.

# MAHR TUNNEL

Cerro de Pasco Corp. Brown, Lester R., Jr. Dempsey, Earle V.

Northern Peru Mining Co. Reed, Sam H., Jr. Wilkham, James F.

Castrovirreina Metal Mines Co. Lyons, Wilfred Alexander

# PIINO

Cia. de Minas del Peru Cope, Louis W. Llewellyn, John E. Cia. Minera Palca, S. A. °Perez, Vargas Mario

# SANTA LUCIA

Lampa Mining Co., Ltd. Curtis, Cecil B. Kapadia, Adi H. \*Pollandt, Fred

Southern Peru Copper Corp.
Barua, Victor F.
Campbell, Gilbert E.
McNair, George P., Jr.
Muse, Robert B.
Pope, Charles B.
Smith, Warren T.
\*Young, William H., Jr.
Other. Other Brindle, Harry M. Smith, W. Ferrin

# TRUJILLO

Northern Peru Min. Corp. Barron, Fernando A. Echevarria, Octavio G., Jr. Hinton, George B. Nobel, Cornelis Stein, Hans H.

# YAURICOCHA

Cerro de Pasco Corp.
Ferguson, Raymond F.
Dominguez S., P.
Elmore, Ismael Co.
Funereau, Enrique R.
Garcia, Marcial
Guggepheimer W. R. Guggenheimer, W. R. Horna, Eliseo

Horna, Moreno Pedro Howard-Goldsmith, R. Koehler, H. J. Labarthe, Hernando Larrabure, Eugne Martonyi, Frederic J. Miranda, L. A. V.

### SURINAME

# PARAMARIBO

Suriname Aluminum Co. Pappas, Hercules C. Valkenhoff, J. H. Van Blyenburg, H. J. R.

### MORNGO

Other Guilonard, J. D. S.

### VENEZUELA

### BARCELONA

Naricual Coal Mine Lares, Carlos A.

### CARACAS

Ciudad Universitaria Kroboth, A. Creole Petr. Corp. Scanlon, Felix C. Explotaciones y Minas \*Kobler, Helmut G. \*Kobler, Heimut G.
Geossa
\*Aguiera, Luis
Inst. Nac. de Canalizaciones
\*Aguierrevere, Pedro I.
Iron Mines Co. of Venezuela
Storms, Frank H.
Luz Electrica de Venezuela
Machado, Morales G.
Venezuelan Caribbean, S. A.
Rott, R. Edward H.
Venezuelan Sun Oil Co.
Young, Herbert A.
Self Employed
\*Freeman, Carlos A.
Other Other her
Baez, Luis M.
Cinco, Lupo F.
De Sola, O.
Fekete, L. A.
Hernandez, John R.
Lopez, Victor M.
Luchsinger, F.
Nevius, Peter T.
Nogales, Antonio

# GUIRIA

Iron Mines Co. of Venezuela Jimenez, Walfrido A.

Nogales, Antonio Pelaez, Eduardo Tello, Manuel B. Thoms, H. W.

# MARACAIBO

Cia. Shell de Venezuela Matthieu, Willem

# MATTIRIN

Creole Petroleum Corp. Bierne, Robert T.

Inst. Venez. Petroquimica
\*Nieto Gil, Gustavo L.

rinoco Mining Co. De Castro, Alvaro R. \*Ruff, Arthur W.

# PUERTO ORDAZ

Orinoco Mining Co.
Burdan, Robert M.
Ellinger, M. C.
Flynn, Alex J., Jr.
Hendershot, F. V.
Hollensteiner, J. P.
Jackson, Wayne D.
\*McFarlane, Ray
O'Brien, Harvey P.
Peterson, Edward C.
\*Rooney, Joseph A.
Wright, Frederick W., Jr.
Van Meter, Wm. S., Jr.
Ward, James M.

# SAN FELIX

Iron Mines Co. of Venezuela Ashe, Herbert J. Brisky, T. J. Guth, Richard E. Jackson, Earl E.

McChesney, James S. K. Shingler, William Harold Wright, Samuel I. Yancey, Leonard C.

# TINAQUILLO

Amveco, C.A. \*Brown, Leroy T.

# FUROPE

# AUSTRIA

MUHLBACH/HOCHKONIG

Kunferbergbau Mitterberg Maczek, Max

### RADENTHEIN

Gen. Refractories Co.

\*Jepsen, Tage L. B.
Oesterr. Am. Magnesit A/G
Awerzger, A.

### BELGIUM

## BRUSSELS

Centre d'Information du
Cobalt
Van Vinckenroy, Victor
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\*Evrard, Pierre L. A. F.
SA Mines, Min. et Metallurg
Lamouline, Etienne L.
Solvay et Cie
Boel, Rene G.
Union Miniere du HautKatanga
Quets, Jerome M.
Terwagne, Richard H.
Theys, Leon F. F.
Verdussen, Jean A. C.
Self Employed
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\*Raick, Julien Oscar
Other

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# HOBOKEN

Soc. Gen. Metallurgique De Merre, Marcel Albert

# LIEGE

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# LIMBURG-MEUSE

Eisden Mines Hosdain, Michel

Faculte Polytechnique Houzeau de Lehaie, Pierre

# WIEZE FLANDRES

Other DeWitte, G.

# DENMARK

HELLERUP

Other Holm, J. C.

# FIRE

# AVOCA

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# BALLISODARE

New Abbeytown Min. Co. MacKenzie, Gordon B.

# CORNAGEEHA

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### DUBLIN

Gypsum Industries, Ltd. Creedon, Cornelius J S. McCormick, Ltd. \*McCormick, Samuel

## FINLAND

# HELSINKI

Inst. of Technology

\*Hukki, Risto T.

\*Mikkola, Aimo K.
Outokumpu Oy.
Maijala, Paavo V.

# KANGASALA

P. I. Mineral Exploration, Inc., \*Tavela, Matti S.

## KOTALAHTI

Kotalahden Kaivos Turunen, Eero

### OTANIEMI

Other Raja-Halli, M.

### OTANMAKI

Otanmaki Oy, Rinne, Risto Oiva \*Runolinna, Urmas O. V.

### OUTOKUMPU

Outokumpu Co. Hakapaa, Erkki A. Heikkinen, Timo Henrik

# YKSPIHLAJA

Outokumpu Oy. Tanner, Heikki

### FRANCE

# ALGRANGE

Lorraine-Escaut Bullet, Alain EPINAL.

Other Saupe, Francis R.

# FONTAINEBLEAU

Prepararion Ind. Com. Quinchon, Francis J.

# FONTENAY-AUX-ROSES

Comm. a l'Energie Atomique \*Vuchot, Lucien

Aux. d'Elec. et d'Enterprise \*Shine, Jack J. E.

# LONGWY

Lorraine-Escaut Guinard, Pierr A.

# MAIZIERES-LES-METZ

Aster, Jacques-Emile Emery, Pierre Javelle, Pierre C.

# MANDUEL

Other Tchintcharadze, J. M.

# MULHOUSE

Mines Domanales de Potasse d'Alsace Callais, Pierre

# NANCY

Other Roubault, M.

# NEUILLY

Other \*Walter, Jacques

## ORSAV

Other Carbonnier, Robert H.

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Mfg.

\*Armanet Jean C Friens et Signaux
Westinghouse
Trystram, Emile R.
Ind. Minieres et Met. d'Outre

Mer
Bellanger, A. J.
Lindqvist & Cie.
Lindqvist, Olof V.
Minerais et Metaux
"Gy, Pierre M.
Ore Mines Owners Ass'n.
Tribauit, Jacques F.
Pechinev.

Thibault, Jacques F.
Pechiney
De Vitry, R.
Penarroya Co.
Gratacap, Maurice
Pagezy, Henry J.
Rey, Maurice
Royale Asturienne Mines
\*Juillet, Jean M.
Lamarche, Alfred C.
SECEMI
Bergeaud, F. J.

Bergeaud, F. J.
Soc. le Nickel
Thurneyssen, Chistian
G. A.
SOGEI

Coche, L. USINOR Damien, Rene Self Employed \*Miller, Mahlon

\*Miller, Mahlon
Other
Blondel, F.
Camplo, Jean
De Choubersky, A.
Destoumieux, P. V
De Wendel, M.
Douglas, James Sainderichin, N. A. Testut, Roger J. Trumphy, Daniel

# ST. GERMAINE EN LAYE

Allard, Marc

# SEINE ET OISE

Other Constantin, Gaston

# TOULOUSE

Other Durand, Jules A.

# GERMANY

# AACHEN

Tech. Hochschule Aachen Gotte, A.

# REBLIN

Other Kohler, Klaus M.

# ESSEN

enersteinkohlen Bergwerke AG
\*Hoevels, Werner C. Other Wasmuht, R. W.

# FRANKFURT

Farbwerk Hoeshst Erberich, Gunther Metallgesellschaft AKT Petersen, Cord

# HAGEN

Other Wilde, H. R. W.

# Peru-Great Britain

# HANNOVER

Kali-Chemie A-G Reuleaux, Otto

### LUEBECK

Other Mantel, H. G.

# MAINZ

Min. Inst. de Univ. Helke, Adolf

### MUNSTER

Hazemag M.B.H. \*Hoffman, Helmut G.

# RECKLINGHAUSEN

Ewald-Kohle A. G.
\*Oberschuir, Max

# RUPPRECHTSTEGEN

Self Employed
\*Stahl, Wilhelm B.

# SOCHUM-WEITMAR

Other \*Wesemann, Heinz F.

# WALDSASSEN

Berebau Bayerland \*Spross, Werner

# GREAT BRITAIN ENGLAND

# ARNOLD

N.C.B., E.M.D. Glossop, Francis G.

### ASHCHURCH

Dowty Min. Equip. Ltd. \*Copper, Peter H.

# AYLESBURY

Richard Thomas & Baldwins, Hacking, Richard A.

# BIRMINGHAM

Other \*Smart, Reginald Cecil

# BLACKBURN

Other Lowe, W. H.

# BOLTON

Other Duckworth, Thomas E.

# CUMBERLAND

British Plasterboard (Holdings) Co., Dale, Brian G

# CHICHESTER

Other Lindsay, L.

# CHRISTCHURCH

Other Beaumont, P. EAST MOLESEY

# Other Eldridge, Alan ERITH

General Elec. Co. Bradford, William H.

# FERRING

Other Forbes, Duncan D.

# GATESHEAD

Nat'l Coal Board Reid, William

# Great Britain-Norway

HARROGATE

Other Walker, L. A.

HOUNSLOW

Thomas, A. M.

KESTON

Seismograph Service, Ltd. Van Der Linden, Emile

KINGSTON ON THAMES

Daniel, Joseph A.

LETCHWORTH

Baker Perkins, Ltd. Patching, Stanley W. F.

LONDON

Atomic Dev. Instruments.

Atomic Dev. Instruments,
Ltd.

\*Klempner, Paul
Britannia Lead Co.
McDermott, Edward D.
B.I.S.C. (Ore) Ltd.
\*Percival, Frederick C.
British Iron & Steel Res. Ass'n
\*Goodeve, Sir Charles F.
Camp Bird, Ltd.
Norman, C. Maxwell
Col. Dev. Corp.
Cochran, Harry A.
Fergusson Wild & Co., Ltd.
Day, Sidney D.
Float-Ore, Ltd.
\*Wrobel, Stanislaw A.
Imp. College of Science &
Tech.
Dannatt, Cecil W.
Inst. of Min. & Metall.
Kerrigan, B. W.
Inst. of Polish Engineers
Dzienisiewicz, J.
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Farrant, James C.
Ltd. 'Mergais & Chemicals

Farrant, James C. Int'l Minerals & Chemicals,

Bradley, William Thomas Mackay & Schnellmann \*Schnellmann, G. Anthony

Rhodesian Selection Trust,
Ltd.
Prain, Sir Ronald L.
Royal School of Mines
Balint, Andrew
Fleming, M. G.
Garnett, Richard H. T.
Mellgren, Olav
Mitcheson, James C.
Ottley, Derek J.
Tomlinson, H. S.
Selection Trust, Ltd.
Fairbairn, Peter E.
Peterson, Robert M.
Richardson, C. M.
Sierre Leone Corp., Ltd.
Sandham, J. E.
R. O. Stokes, & Co., Ltd.
"Stokes, Roger P.
Uddeholm, Ltd.
"Middup, C. G.
Zinc Corp., Ltd.
Connor, W. Watson
Self Employed
"Allan, John Caldwell
Appleyard, Kenelm C.
"Gill, Donald
"Jones, William David
Other
Boise, Chas W.

\*Jones, William David Other Boise, Chas. W. Burwood, Douglas S. Deane, M. Shella Dinsdale, J. R. C. Halle, Edwin L. Hirst, Tom Horwood, C. Baring Howe, Alan Selkirk, W. Stokes, Rupert O. Walter, A. J. P.

MANCHESTER

Oldham & Son, Ltd. Statham, Cyril D. J. Low Inn A

MOORGATE

United Steel Companies, Ltd. Saniter, Frank H.

PRESCOT

Other Taylor, K.

REDRUTH

South Crofty, Ltd. Acland, Thomas St. H.

SCUNTHORPE

Appleby-Frodingham Steel Co. o. Keeve, Lewis

SEATON

Other \*Pryor, Edmund J.

SHEFFIELD

Newcombe, Leonard A. Statham, I. C. F.

SHOTLEY BRIDGE

Nat'l Coal Board Nimmo, James Adam

STEVENAGE

Warren Spring Lab. Collins, Douglas Neil Muller, Leslie D. Robinson, Alan Jeffrey

STOCKTON-ON-TEES

A. C. C. (Chrome & Chemicals), Ltd. Burningham, Arthur C. J. Other Dixon, A. H.

STOKE-ON-TRENT

Nat'l Coal Board Bacharach, John P. L.

SUNNINGHILL

Other Higgins, A. Howard

WALLSEND

Thermac Syndicate, Ltd. Stanyon, Roger W.

Gen. Electric Co. Jenkins, Ivor

WORCESTER

Mining Engineering Co., Ltd. Higgins, Bernard Arthur

SCOTLAND

BONNYBRIDGE

J. G. Stein & Co., Ltd. Malcolm, Robert

BRIDGE OF CALLEY

Wardrop, J. G. L.

BUCKHAVEN

Buckhaven Technical College \*Napier, Alexander Nicol

CUMNOCK

Anglo Austral Mines, Ltd. Jones, A. E.

FORFAR

Other Jones, Charles H.

GLASGOW

Tharsio Sulphur & Copper Co., Ltd. Rutherford, William P. Other McCosh, A. K.

KINGLASSIE

Costain Mining, Ltd. White, John F. C.

NEWCASTLETON

Other Jackson, James

PLEAN STERLING

Other Thorneycroft, T. H.

TROON

Hillhouse Quarry Co. Masterton, William F.

WESTLOTHIAN

Moore, Robert A.

WALES

CARDIFF

Nat'l Coal Board Lancaster, Robert C. Other Jones, John Moss

LLANELLY

Crawley Ind. Prod. Ltd. Hugill, Clifford

NEATH

Jeffreys, Rhys V.

PONTARDULAIS

Other Jones, Meurig P.

PORT TALBOT

Steel Co. of Wales Cartwright, William F.

GREECE

ATHENS

**Bureau Tecnique Dimitry** 

Bureau Tecnique Dimitry
Scalistiri, Dimitry Michael
Scalistiri, Dimitry Michael
Eleusis Bauxite Mines, Inc.
Scalistiri, Michael D.
Hellenic Chrome Mines, Ltd.
\*Tsoutrellis, Chapalampos
Hellenic Co. of Chem. Prod.
Ltd.
Moussoulds, S. L.
Inst. of Geology &
Sub-surface Research
\*Caramantzani, Maria
\*Tsailas, Dimitrios
Zachos, Kyriakos E.
Ptolemais Lignite Min. &
Ind. Co.
\*Georganias, Constantine

Ind. Co.

\*Georganias, Constantine
A. D.
Silver & Baryte Ores Min.
Eliopoulos, George
Tecn. Nat'l University

\*Catrakis, Stavros D.
Other

ner Garanis, N. G. Siotis, George J. Van Drunen, William

LAURIUM

Cie. Francais des Mines du Laurium Caladzopoulos, John

MYKONOS

Mykobar Mining Co. Presanis, Anargyros John

THESSALONIKE

Other Smith, T. A. Woods

VOLOS

A. P. Apostolidis Mines Apostolidis, Nicholas C.

HUNGARY

MISKOLC

Technical University
\*Boldizsar, Tibor

ICELAND

REYKJAVIC

Univ. Research Inst. Tryggvason, Tomas

ITALY

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Inst. Siderurgico Finsider
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MERANO

S.T.I.M. \*Zoppis, Renato

MILANO

Instito Breda
\*Reggiori, Alessandro
Mineraria Preaipina SPA
Jefferson, Delerene K.
Montecatini, S.A.
Rossi, Giovanni

Saima Giusti, Rind M. Other Salomone, Mario

PISA

Inst. Geol. University Dessau, Gabor

ROME

Com. Nazionale Per 1 Com. Nazionale Per 1
Energia Nuc.
Pantanetti, Fabio
Ente Zoifi Italiani
Gallina, Mario
Soc. Min. & Metall di Pertusol
Audibert, Paul
Self Employed
\*Thomas, Conrad W.
Other

Other
\*Christensen, John A.
Silvestro, Franco
Usoni, Luigi

TORINO

\*Debenedetti, Arturo Liprandi, Giuseppe

TURIN

Politecnico di Torino Stragiotti, Lelio Other Jannello, E.

LUXEMBOURG

ARBED Schmit, Rene

MONACO

MONTE CARLO

Joy International S. A. y International S. A. Burr, George H. \*Coffey, Leonard M. Golson, George A. letter, Robert P. Steidle, Edward, Jr. Wheeler, H. R.

NETHERLANDS

ARNHEM

Holmetal Van der Graaf, J. B.

Delft University
Van Bevervoorde, W.
Technical University
Bot, A. C. W. C.
\*De Wijs, Henri J.
\*Seldenrath, Th. R.

DEN DOLDER

Other Van der Hoeven, F. G.

GELEEN

Dutch Sta. Central Laboratory Paulen, A.

HENGELO

Kon Nedrl. Zoutind. Bock, Paul

THE HAGUE

N. V. Billiton MIJ N. V. Billiton Made Ebbinge, Herman W. H. Muller & Co. "Van Nordheim, Rudolph Van Goudvelden, N. V. Sarakreek Goudvelden, N. De Haan, W. Other

\*de Voogd, Nicolaas
Haighton, A. L.
Van Bosse, P. M.

HILVERSUN

Other Corts, Cornelius W.

HOENSBROEK

Maatsmynee-in-Limburg Kryjgsman, Centinus Other Janssen, A. T.

NAARDEN-BUSSUM

N. V. Chemische Fabriek \*van Arkel, Hubertus

ROTTERDAM

N. V. Vulcaan Koeten, Klaas

HORWAY

BJORNEVATN

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KIRKENES

Other Braaten, Tormod

LOKKEN VERK

Orkla Grube AB Okkenhaug, A

Fosdalens Bergvergs A/S
\*Amdahl, Thor M.

MORANA A/S Bleikvassli Gruber \*Fangel, Henning

OSLO Norges Geol. Undersokelse Poulsen, Arthur O. A/S Sydvaranger Johansen, Johan Kraft Lund-Andersen, Hans Lund, Worm

Other Kiil, Erling

RANA A/S Bleikvassl Gruber
\*Jonsson, Ingebrigt

SKOROVATN

Electrokemisk A/S Engzelius, Johan Gustaf

Electric Furnace Prod. Co. Reinertsen, K.

SUADA

SULITJELMA Other Christoffersen, R.

TRONDHEIM

Mineral Dressing Laboratory \*Digre, Marcus Norwegian Inst. of

Technology \*Hofseth, Arne Other \*Braekken, Haakon Lange, Johan J.

### PORTUGAL

BELMONTE

Portuguese American Tin Co. Robb, Alastair H.

FOZ DE AROUCE

Other De Carvalho, A. Pires

FUNDAO

Beralt Tin & Wolfram Minas Panasqueira \*Chaston, Ian R. M. Mantell, K. E. Turner, J. F.

LISBON

Aluminio Portugues \*Andringa, G. P. Other Flores, Francisco D. A. Garcao, J. C. S. Vieira, H.

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\*Cerveira, Alberto Morais

### SPAIN

BILBOA

Orconera Iron Ore C. L.
\*Balzola Menchaca, Jose Other Cerero, Ramon M.

MADRID

Esso Standard Espanola Kabana, Manuel Cabrera \*Sanz, Antonio Bernad Guggenheim Bros. Kimball, Richard H., Jr. Technicom
\*Merlin, Robert A. Other Orti, Carlos

SERON \*

Wm. H. Muller & Co. Steensma, Rintje S.

TORRELAVEGA

Real Co. Asturiana de Mina Ludena, Julio G.

# SWEDEN

DJURSHOLM

Mogensen & Co.
\*Mogensen, Fredrik K.

von Eckermann, Harry

FAGESTRA

Fagestra Bruks AB Arvidson, Ernest A.

FALLIN

Stora Kopparbergs Boman, Jan E. Suoberg, Sven E. Other Abenius, Hakan V.

COTEBORG

SKF Lundgren, Bengt G. S.

KARRGRUVAN

Norbergs Grufaktiebolag Anestad, N. Stellan R.

MALMBERGET

LKAR Alin, Ragnar Other Fagerberg, Bengt C. NACKA

A. Kjelgaard \*Kjelgaard, Axel W.

RIDDARHYTTAN

Riddarhytte AB Karlen, Sten Erik J.

Sala Maskinfabrik AB Johanson, Edvin B.

SANDVIKEN

Sandviken Steel Works Angel, T. G. Eberman, Carl B.

SKELLEFTEA

Tekniska Gymnasiet \*Rothelius, Ernst J. A.

SKELLEFTEHAMN

**Bolidens Gruvaktiebolag** Noren, Bertil A. Wallden, Sven J.

STOCKHOLM

AREM Co. Ltd. ABEM Co. Ltd.

"Hedstrom, Helmer
Atlas Copco AB
Gibson, Bengt G.
Bolidens Gruvaktiebolag
Herneryd, Olov F.
Grangesberg Co.
Hjortzberg-Nordlund,
Borie, H. W.
A. Johnson & Co.
Dalhammar, Sven A.
Likab

Lkab

Berggren, Olof
Royal Inst. of Technology
\*Janelid, Ingvar
\*Kihlstedt, P. G.
Wiberg, F. Martin
S.G.U.

Henricksen, Svend E. J. Svenska Diamantbergborrings AB

\*Wallin, Karl G.

Swedish Assn. of Engrs.

Akerman, Oskar M. J.

Other Lupander, Kurt

STRASSA

Trafik AB Grangesberg-Oxelo Lundin, Bror-Knut

SUNDBYBERG

Craelius Svenska Diamant Jacobsen, H. Sommerfeldt

VYSJORERG

AB Yxsjo Gruvor \*Berglund, Lars E

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BASEL

Ciba, Ltd. Schaufelberger, Felix A.

GENEVA

North American Aviation S.A. Hilderbrand, Howard H. Other Aries, Robert S. Siegfried, W.

MINUSIO TICINO

\*Gutacker, Wilhelm Bruno

NEWHAUSEN AM RHEINFALL

Aluminium Industrie AG Bloch, Ernst A.

Booz Allen & Hamilton, Int'l \*Parks, F. Newton

Arthur D. Little, Inc.

YUGOSLAVIA

BELGRADE

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Bergman, Raoul G.
Faculty of Mining & Geology
Gluscevic, Branko A.

SISAK

Other Logomerac, V. G.

AFRICA ANGOLA

NOVA LISBOA

Cia Mineira Do Lobito Ferguson, Louis W. Machado, F. J. de Sousa

BRITISH WEST AFRICA

BATHURST GAMBIA

Cambian Min. Ltd. Thomas, Ronald

CONGO, REPUBLIC OF

Comite Natl. Du Kivi Fournier, Clement

ELIZABETHVILLE

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GOMA-KIVU

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KALIMA

Symetain Smits, H. A. R.

MFOUATI PAR LOUTETE Cie. Min. du Congo Francais Maerten, G. C.

DAHOMEY

COTONOU

Service Des Mines & de la Geologie \*Escande, Edilbert

EGYPT

CAIRO

Egyptian Color Factory Nassim, Ramses L. Self Employed °El Alfy, Edward M.

FRENCH WEST AFRICA

CONAKRY

Bauxites du Midi Burki, Axel N.

GHANA

AKWATIA

Cons. African Selection Trust Ltd. Gordon, I. C. A.

NSIITA WASSAW

The African Manganese Co. Bolsover, J. Charles

**OBUASI** 

Ashanti Goldfield Corp. Pooley, Roger H. Watson, John L.

IVORY COAST

ABIDJAN

Cie., Mokta \*Chouteau, Rene M.

KENYA

MOMBASA

Mahle Services Ltd. Stott, George E.

NAIROBI

Katuma Mining

\*Lavallee-Poussin, J.

Williamson Diamonds Ltd.

Currie, John M.

KISHMU

Macalder Nyanza Mines, Ltd. Lavers, H. A. \*Stansmore, Marshall F.

LIBERIA

MONROVIA

mco (Lib. Amer. Swed. Minerals Co.)

Beyer, Martin G.

Mine Management Associates, Mine Management Associated
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Erickson, Floyd W.
Erickson, Peter W.
Hanson, S. A.
McKereghan, George F.
Platt, Philip L.
Bureau of Natural Resources
\*Massaquoi, A. Momolu
Bureau of Mines
Sherman, Arthur

LIBYA

TRIPOLI

Mobil Oil of Canada, Ltd. Olson, Roy C., Jr.

MOROCCO

CASABLANCA

Soc. Min. et Met. de Penarro Audisio, Francesco
Ste. des Mines de Zellidja
Pellerin, Jean E. Other Savin, Robert

BOU-BEKER

Societe des Mines
 \*Chlique, Daniel
 \*Paulhac, Jean
Ste. Nord Africaine
Young, F.

TOUISSIT PAR OUJDA

Other Gregoire, Eugene

HIGERIA

BOKURU

A. O. Nigeria Ltd. \*Baird, Robert M.

The Jantar Nigeria Co., Ltd.
Thomson, James A.
White, Jack
Ministry of Mines and Power
Coakley, Patrick D.
Nigeria Dept. of Mines
Ndulue, James A.
Tin & Asso. Min. Ltd.
McNell, Alex. W.

PORT HARCOURT

Shell-BP Pet. Dev. Co. Lee, Robert L.

HORTHERN RHODESIA

BANCROFT

Bancroft Mines Ltd. Barlin, Bernard

BROKEN HILL Rhodesia Broken Hill Dev. Douglas, W. B.

CHINGOLA Nchanga Cone Copper Mines

Page, Eric W.

Norway-South Africa

KALULUSHI

Other Norrie, James P. Wright, Anthony J.

Rhokana Corporation Ltd. MacLeod, Donald Other Fisk, Bernard G. Harris, L. R. Martincevic, Nicholas

LUANSHYA

Roan Antelope Copper Mines Reid, James L.

MUPULIRA

Mufulira Copper Mines, Ltd. Ebsworth, Neville E. J. Hogg, William John Humphriss, John O'Connell, C. A. Other Gilmour, Norman T. Thomas, G. W. Young, David

NDOLA

Dept. of Mines Baillie, J. E.

RUANDA-URUNDI

KIGALI

Other Olbrechts, P. J.

SENEGAL

DAKAR

Taiba Phosphates \*Spada, Mario

SOUTHERN RHODESIA

BULAWAYO

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FORT VICTORIA

Election Mine \*Barker, Henry T.

GWELO Government Mines Dept. Davey, Bernard

SALISBURY Aero Service Webster, Jack C. Anglo-American Corp. of So. Af. Ltd. Af. Ltd.
Gunning, H. C.
Heath, K. C. G.
Sergiades, Frank Richard
Taylor, Howard H.
M.T.D. Alaska
Hall, William B.
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Anderson, Robert B.
Rhodesian Selection Trust
Exploration, Ltd.
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Other

Other Harries, D. R. Novotny, Robert T. Wallenberg, Peter

UMTALI

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SOUTH-WEST AFRICA KOMBAT

Tsumeb Corp., Ltd. Gevers, Rainer

TSUMER

Tsumeb Corp., Ltd. Banghart, Richard W.

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BLYVOORUITSIG

Other Mellish, Michael

RENONI

Other Berglund, C. B. E. BOKSBURG

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CHARLETONVILLE

Fisher, Roger C. Von Muller, M. J.

CULLINAN Premier Diamond Mining Co. Gilbert, Otto H.

GLEN HARMONY

Harmony G. M. Co. Ltd. Sesink Clee, Rudolf A.

ILLOVO BEACH

Umgababa Minerals, Ltd. Jackson, Ernest J.

JOHANNESBURG

African Metals Corp. De Villiers, J. S.
Glatthaar, Ulrich V.
nerican Consulate Gen.
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Keyes, William F.
Anglo American Corp. of
S. Af., Ltd.
Brown, Thomas Cedric
Waters, Arnold E., Jr.
Anglovanl
von Maltitz, Adrian A.
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Hultquist, C. E.
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\*Ketelbey, Hugo F. W.
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S. Africa Cyanamid Ltd.
Dykhouse, B. S.
Wilder, Glenn S.
Tweefontein United Coll. &
Withank Consol. Coal Mines
Ltd.
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Ltd. Lee, R. Antony
Union Corporation, Ltd.
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Witwatersrand University
\*Mendelssohn, Edgar
Morris, Hugh C.
\*Pretorius, Desmond A.
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Other

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Chelius, Dieter R. Chelius, Dieter R.
Dixon, L. W.
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Hadfield, H. C. P.
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Prentice, Thomas K. Summers, H. A. Van der Merwe, O. T. Wartenweiler, Fred

KIMBERLEY

De Beers Cons. Mines Gallagher, W. S.

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Other \*Brown, Samuel Rollins

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STILFONTEIN

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Douglas Colliery, Ltd. Moore, James Henry

VENTERSDORF

Hattingh, A. M.

WELKOM

Other Scott, Peter M.

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MPANDA

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MWADUI

Williamson Diamonds, Ltd. Hunt, G. F.

TOGOLAND

MANGO

Gravillou, A. L.

TUNISIA

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Royale Asturienne des Monthiers, Bernard M.

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ENTERBE

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Kilembe Mines Ltd. Langevad, Eric J.

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Cyprus Mines Corp.

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Barnett, George M.
Burgess, John D.
Busch, William D.
Busch, William D.
Egerton, Robert H. L.
Hurley, Nick J.
Wiggins, Vurbel C.
Wood, Fremont E.
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Manglis, Costa Per

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Kampsax \*Jepsen, John L. B.

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British Embassy Roberts, Adrian J.
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Jones, Erwin Beck
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Martin, Dan W.
Other Other Fotouhi, Manuchehr Zahedi, A.

ISRAEL

EILAT Israel Mining Industries, Tim-na Copper Mine Vered-Weiss, Jacob H. Timrah Copper Recovery Sandler, Harry

HAIFA

Industries Development Corp.
\*Fuchs, Warren
\*Hoffman, Itzhak
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\*Mitzmager, Abraham

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Waylett, William J.
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Other Sunay, Necdet H. ISTANBUL

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\*Berent, Ihsan R.

Turk Maadin S.

\*Rechenberg, Hans P.

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Tun, Hla
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Natl. Govt. of China Hao, Wong Wen

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Kaohsiung Cement Plant Chang, K. Y. Chiang, Ting-Ih

SUAO YI-NAN

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Taiwan Cement Corp. Chen, Hou F. Other Lu, Paul H. H.

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CIDADE DE GOA

Other Devlin, Robert

MARGAO

Other Burdick, Sherman R.

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Strachan & Co., Ltd. Strachan, G. Douglas

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Yan Hing Mining Co., Ltd. \*Hui', Stephen S. F. Other Yui, Tao K.

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Rajagopalaswamy, K.
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Other Aiyer, K. V. Patel, M. S. Sengupta, K. B.

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Sen, N. R.
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Robertson, Donald B.

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FUKUOKAKEN

Kobukuro Iron Works Co., Dennosuke, Ito

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Other Iwasaki, Iwao Okubo, Kuzuo Furuichi, Rokuzo Shimokobe, Ryo Tamura, Tadao Kasahara, Tamio

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Kim, Sung Ho
Korean Consol. Min. Co., Ltd.
Dutcher, Howard G.
\*Nonini, Lewis G.
Kuksan, Motors Co., Ltd.
Choi, H. S. U. S. Operations Mission Heikes, George C. Lee, Joung H.

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Gopeng Cons., Ltd. Goldsmith, Robert J.

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Dept. of Mines Res. Div. Abdullah, M. Y. Vallentine, Dunne & Assoc., Seng-Hon, Chan

Other Beh, Chen Aun

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Malayan Mines Department
Lim, Keng K.
Pacific Tin Cons. Corp.
Cleveland, Norman
Vallentine, Dunne & Assoc.,
Ltd. \*Fletcher, John Raymond \*Waugh, Percival Ewan

PENANG

Siamese Tin Syndicate, Ltd. Pocock, B. G.

TAIPING

Kumunting Tin Dredge Co., Ltd. McCluggage, Joseph L. Other Tham, Weng Sek

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KATHMANDU

Nepal Bureau of Mines Malla, P. B.

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Broken Hill Pty. Co., Ltd.

orner, Howard K

Hornibrook McKenzie Clark Pty., Ltd. \*Beattie, George Andrew

Colonial Sugar Ref. Co., Ltd. King, Malcolm G. Commonwealth Min. Invest.,

McMahon, Kenneth H. Kandos Cement Co., Ltd. MacTaggart, M. L.

Other Van De Plasse, J. M.

Hewett, Ernest F.

Medburn Pty., Ltd. McKensey, Stanley

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WOLLONGONG

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McColl, Ian G.

her Braham, P. G.

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Univ. of Queensland
\*Gregory, Cedric E.
White, Frank T. M.

Mount Isa Mines, Ltd.
Blanchard, Roland
"Carlyon, William R.
Davey, John Michael
Draper, Neil
Dunlop, Geoffrey A.
Fisher, George Read
Foots, James W.
Harraway, D. H.
Hoffmann, Carl W.
Houston, Michael L.
Kruttschnitt, Julius

Kruttschnitt, Julius Lyons, Denis Gabriel

MOUNT MORGAN

Mount Morgan, Ltd. Sheil, Glenister

Other

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Peko Mines

BATCHELOR

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\*Mirza, Mahmood Beg
Tipton & Kalmbach, Inc.
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### THAILAND

BANGKOK

National Energy Authority Tewtong, Dej Royal Dept. of Mines Svanholm, John W.

BHUKET

Tin Dredging Kanjana-Vanit, Rachan

## VIETNAM

SAIGON

Capitol Engineering Corp.
\*Lindberg, Richard E.
Natl. Nong Son Coal Mine
Kinh, Hoang Other Ho, Au-Ngoc

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CANBERRA

Bureau of Mineral Resources Barclay, John Hill, John K.

# NEW SOUTH WALES

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Broken Hill South, Ltd. Howell, Murray W. \*Sainsbury, Garrett M. The Zinc Corp., Ltd. Davis, W. J. N. Other Crone, James G. D. Kleeman, J. R.

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Cobar Mines Pty., Ltd. Mitchell, D. T.

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KILLARA

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Other O'Connell, V. T.

India-Australia

Cunningham, Kirby T. Newman, Gavan Pullar, S. S.

### SOUTH AUSTRALIA

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ectrolytic Zine Co. of Aust., Hall, Graham

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McLennan, Ian M.
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Whitehead, Robert C.
Wilson, Adam L.
The Broken Hill Assoc.
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Russell, Reuben S.
Bureau Min. Resources
"Wiebenga, William A.
Commonwealth Scientific
Ind. Research Org.
Wark, Ian W.
Consol. Zinc Pty., Ltd.
Mawry, Maurice Alan
Nixon, John C.
CS.I.R.O.
"Restarick, Clifford J.
Cyanamid Aust. Pty., Ltd.
Ashton, Bruce E.
Jackson, Norton
O'Malley, G. B.
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Kirby, Noel S.
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Personnel Admin. Vic., Ltd.
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Other Nichols, Leo

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Univ. of Melbourne \*Carr, John Stewart

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ALBANY

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COMO

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\*Utting, Edward P.

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Lake View & Star Gold Mines, Kozuh, Danilo

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Aust. Iron & Steel Pty. Sheppard, R. T.

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Maung, Nyi Other Fairmaid, Gordon H.

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Other Pickering, Bruce R.

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Other Rapadzi, Albert

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Benguet Cons., Inc.
Bean, Floyd E.
Callow, K. J.
Haussermann, John W.
Bennett Securities
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"Gozon, Benjamin M.
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Agents
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Marsman & Co., Inc.
Lavrov, Sergey E.
Philippine Iron Mines, Inc.
"Frost, John E.
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A. Soriano & Co.
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Lewis, Dan E., Jr.
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"Gapud, Honesto A.
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"Ettinohass M. A.

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Javellana, Manuel C.
Muehl, Wallace W.
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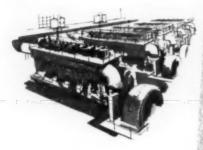
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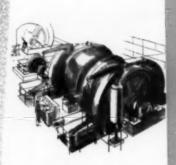
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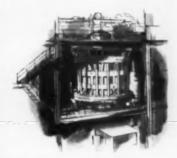
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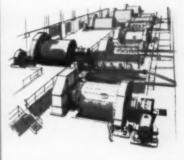
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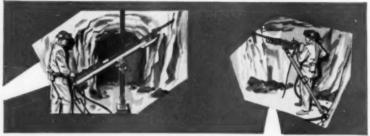
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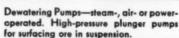
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# AIME-SME NOMINATIONS FOR 1962

(Pages 897-903)



Southern Research Institute and. 24th Annual Joint Solid Fuels Conference Oct. 3, 4, 5, 6, and 7 See page 896.

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SME Preprint List on page 914.

For Information on AIME Transactions (Mining) Vol. 220, 1961 see page 676.

# KEEPING POSTED

Froth Flotation Commemoration page 894.

Footnote to Las Vegas IndMD Newsletter page 900.

Old Timers Award page 894.



See page 654





World-famed Pikes Peak towers over the Garden of the Gods near Colorado Springs. By attending the Froth Flotation Commemoration in Denver this fall you can see it.

# Field Trips Featured At Flotation Meeting

The Golden Anniversary of Froth Flotation in the U.S., sponsored by the Mineral Beneficiation Division of SME, is an occasion to honor the senior members of the industry whose efforts created the industry as we know it today. The chief feature of the commemoration is the meeting in Denver, September 17 to 20. The program includes six technical sessions comprising 30 papers by authors of international authority; ample free time in which to greet friends and to meet the authors; a social schedule of welcoming luncheon, cocktail party, MBD Scotch Breakfast, and banquet; a special mountain tour and luncheon for the ladies; and convention closing field trips.

Principal speaker at the banquet on September 19 will be Frank Milliken, president of Kennecott Copper Corp. and a former winner of the Richards Award for his work on the development of beneficiation processes, including flotation for the ilmenite ore at Tahawus, N.Y.

Trip #1 to Golden, Colo. will depart, via bus, Thursday morning, September 21 at 8 o'clock. At Golden, the group will be conducted on tour through the metallurgical department of the Colorado School of Mines, and, if time permits, a short visit to the campus proper, library, and the rock museum. The group will then proceed to the Coors Brewery for a guided tour of the plant, plus a brief-but-refreshing pause at the Coors' tavern. Lunch at the Colorado School of Mines cafeteria will follow. A visit to the School's Research Foundation concludes the day's activities, and the group will return to Denver at approximately 5 pm.

Trip #2 to Climax, Colo. will leave at 7 a.m. on Thursday. The approximate 100 mile trip is through the Rocky Mountains, and the superbyiews offer a special inducement for

making this excursion. The group is scheduled to arrive at Climax at 10 a.m. for a conducted tour through the mill, flotation, and by-products plant of Climax Molybdenum Div., American Metals Climax. At the conclusion of the tour a miner's luncheon will be served. A question-and-answer period will follow the luncheon. The group is scheduled to return to Denver at approximately 6 pm. Due to the technical nature of this plant inspection, this trip is not recommended for the ladies.

For complete program details see the June issue of MINING ENGINEER-ING, page 616.

# Council of Education Names 1962 Officers

The recent report of the Nominating Committee of the Council of Education has listed the Council's officers for 1962. Effective at the next AIME Annual Meeting (February

18-22), this year's Vice Chairman, A. W. Schlecten, Professor of Metallurgy at the Missouri School of Mines, will automatically assume the duties of the Chairman for 1962. Charles V. Kirkpatrick, Chairman of the Department of Petroleum Engineering at the University of Houston and 1961 Chairman of the Council, will become Past-Chairman and a member of the Executive Committee. Truman H. Kuhn, Dean of Faculty at Colorado School of Mines has been nominated for the 1962 Vice Chairmanship, and Robert L. Whiting, Head of the Department of Petroleum Engineering at A&M College of Texas, has been similarly nominated to be Secretary-Treasurer for the forthcoming year. The new Executive Committee Member-at-Large who will serve a 3-year term is Charles F. Weinaug, Chairman of the Department of Petroleum Engineering. University of Kansas.

# **Old Timers Club Award**

On April 28, 1961, Shelley G. Hughes, president of the Differential Steel Car Co. and member of the coal industry's Old Timers Club presented to John Patterson, outstanding senior mining engineering student at Ohio State University, an engraved Mido watch for his academic achievements.

John Patterson has been employed by U.S. Steel Corp. and the Mining Division of Crucible Steel Corp. and the Morton Salt Co. in their 2000-ft-deep rock salt mine in Painesville, Ohio. Mr. Patterson is looking forward to obtaining a B.S. in mining engineering and, by June of 1962, a Masters degree in the same area. He is planning to carve a career in the industry, and we trust that his contributions to its advancement will be significant.



S. G. Hughes extends his congratulations to John Patterson at the speakers stand during presentation ceremonies before 75 members of the Ohio mining fraternity.



E. D. SPAULDING



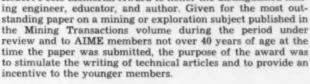
W. E. HEINRICHS, JR. 1955



R. E. THURMOND, JR.

# PEELE AWARD FUND ESTABLISHED

In 1953, the Mining and Exploration Division established the Robert Peele Memorial Award to honor the distinguished min-



Robert Peele directed the editing and publishing of the first mining engineering handbook. Since it first appeared in 1918, The Mining Engineer's Handbook or "Peele", as it is generally known, has been the standard reference for the profession.

That the Division established an award in Robert Peele's name is fitting. Initially it was hoped that MINING ENGINEERING would be able to provide the necessary funds to finance the awarda certificate and \$100. However this was not possible and the award was financed by the personal contributions of committee members. Awards were made to the men shown on this page during the years 1955 to 1959 inclusive, but in fairness to committee members, the award was then suspended until adequate financing could be assured.

During the past several years, Executive Committees of the M&E Division have studied the matter and decided that a permanent fund should be established. Action toward implementation of this decision was postponed during the United Engineering Building Fund Campaign at the request of the AIME Board of Directors. With permission granted at the June 20th AIME Board Meeting, the M&E Division Executive Committee has established a "Fund for Peele."

The "Fund for Peele" has as its objective the sum of \$10,000or less than \$1,00 for each SME member who has expressed an interest in the fields of mining and exploration! A "Fund for Peele" Committee has been appointed to organize the drive to revive this coveted award. Composed of J. M. Ehrhorn and J. C. Fox, the Committee will welcome all contributions. Please send your check for \$1.00, or more to "Fund for Peele" Committee, c/o Society of Mining Engineers of AIME, 29 West 39th St., New York 18, N. Y.

> The Robert Peele Memorial Award To Honor Peele-To Honor A Member

1957



L. A. PANEK

1959



F. R. JONES

1958

I. JANELID

1956



A. F. AGNEW

# Joint CIM-SME Meeting Scheduled for Ottawa

Plans for the Joint Meeting of the Industrial Minerals Divisions of CIM and SME in Ottawa, Ontario, on October 1 to 3 have now progressed to the point where a successful meeting can be confidently forecast. Most of the industrial mineral operators in southeastern Ontario and southwestern Quebec have agreed to be hosts for plant visits. All functions will be held at the Chateau Laurier, and registration for the meeting and post-meeting tours will start on Sunday afternoon, October 1. Plans are

to present three technical papers on each of Monday morning, Monday afternoon, and Tuesday morning sessions. Also, an attractive program is being arranged for the ladies.

In order to receive more information including brochures, maps, field-trip data, the technical program, ladies program, etc. circle No. 100 on the Reader Service Card found on page 661. Additional information will be published in MINING EN-GINEERING when available. If other information is desired, write to:

J. E. Reeves, Secretary Joint Meeting Committe c/o 40 Lydia Street, Ottawa, Ont., Canada

# CUT ORE WASHING AND ORE SLURRYING COSTS WITH AN EAGLE LOG WASHER

Eagle Log Washers are giving excellent performance on iron ore, manganese, phosphate, calcium carbonate and other metallic and non-metallic minerals. They are designed for tough service-14" diameter tubular steel log shafts are non-deflecting-marine type lower bearings are water lubricated under pressure. Paddles have 2-piece replaceable corrugated Ni-Hard chromium-nickel iron alloy shoes to resist wear; only top half of shoe need be replaced when worn, as shown-adjustable discharge gates for wash water on both sides of tub-totally enclosed gear drive runs in an oil bath.

Eagle Log Washers 36" diameter (tip to tip of opposing paddles) handle ore up to 4" dia. -48" dia. washers for ore up to 7" dia.

Choice of tub lengths. Special log washers for slurrying operations.

Send for Bulletin 760 describing Eggle Log Washers, Eagle Fine Material Screw Washers and Coarse Material Screw Washers and Eagle Water Scalping-Classifying Tanks.





# EAGLE IRON WORKS

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# Birmingham To Be Host To Coal Men in the Fall

## **ASME-SME Joint Solid Fuels** Conference

The 24th Annual Joint Solid Fuels Conference, sponsored by the Fuels Division of ASME and the Coal Division of SME, will be held in Birmingham, Ala., from October 5 to 7. This year the date and place has been chosen to form a twin-bill with the Southern Research Institute Conference which will meet on October 3 and 4 at the Dinkler-Tutwiler Hotel.

Programming is in the tentative stage at this writing. Registration begins Wednesday evening, October 4 at the Conference headquarters in the Dinkler-Tutwiler Hotel. Four technical sessions are planned at which 11 papers will be presented covering coal preparation, coal quality control, coal handling for industrial steam plants, operation of vibrating stoker, coal utilization, mining, pulverized coal explosions, and underground gasification.

An informal luncheon is planned for Thursday, October 5 without a speaker. A luncheon address is planned for the following day. The principal address of the Conference will be given at the banquet on October 5. A field trip is planned for the morning of October 7—tenta-tively it will be a visit to the Wil-sonville Steam Plant.

### Southern Research Institute Conference

Future Coal Markets is the theme of the conference sponsored by Southern Research Institute. Its purpose is to explore coal's technological horizons and examine the economic significance of future technical developments. Among the speakers will be Philip Sporn, president of American Electric Power, who will discuss Coal or Atomic Energy? and George A. Lamb, director of the new Office of Coal Research, Dept. of Interior, who will talk about the research program being conducted by that organization.

Other speakers will describe new developments relating to coal chemicals, high Btu coal gas, and the coal burning gas turbine. New trends in coal production, transportation, and marketing will also be explored. Broader applications of the coal-bywire theme, including electrification of railroads, will be discussed.

The conference begins the morning of October 3 and ends with a luncheon address on October 4.

Since the fall months always seem to present a full calendar of events, it is not too soon to start planning to include these events in your schedule.

# SOCIETIES NAME 1962 INSTITUTE OFFICERS AND DIRECTORS



R. V. PIERCE

Roger V. Pierce, mining consultant with headquarters in Salt Lake City. has been nominated as AIME President-Elect by the Society of Mining Engineers to take office as President in 1963. In addition to his consulting work which he began in 1947, he is president of Shaft & Development Machines Inc., Machinery Center Inc., and United Idaho Mining Co. Mr. Pierce is a graduate of Montana School of Mines and during his student days and for a time thereafter worked for The Anaconda Co. He followed that with work in the Lark-Bingham district of Utah, and the Salmon River area of Idaho. From 1936-1946 he was associated with the Ingersoll-Rand Co. in mine mechanization work.

### Vice Presidents-Directors

William B. Stephenson, SME President-Elect, is serving a three-year term on the AIME Board of Directors and has been nominated by the Society of Mining Engineers to serve as AIME Vice President for one year. He is president of Allen-Sherman-Hoff Pump Co., a position he has held since 1956. He first became affiliated with the company in 1938 and left in 1948 to become manager of Ash Export Co. In 1951 he returned to Allen-Sherman-Hoff Pump Co. as vice president.

James C. Gray, currently SME President, has been nominated a Vice President of AIME by the Society of Mining Engineers. Mr. Gray is administrative vice president, raw materials, for U.S. Steel Corp. in















C. C. LONG



dent of Gulf Oil Corp., has been nominated as AIME Vice President by the Society of Petroleum Engineers. He joined Warren Petroleum Corp. in 1947 and was vice president when the company merged with Gulf. He is a graduate of the University of Oklahoma.

Pittsburgh. His association with the company goes back to 1937.

Herbert F. Beardmore, vice presi-

Earl M. Kipp, 1961 President of the Society of Petroleum Engineers, has been nominated by the Society as AIME Vice President. He is special consultant-production problems on the staff of the vice president in charge of Producing for Standard Oil Co. of California, a position he assumed early in 1958. He joined the organization in 1936 after graduation from Stanford University.

Carleton C. Long has been nominated by The Metallurgical Society to serve another term as AIME Vice President. He has also been chosen to serve on the AIME Board of Directors for two years to fill out R. C. Cole's unexpired term. Mr. Long, who has been associated with St. Joseph Lead Co. since 1935, is director of research, zinc smelting division.

J. S. Smart, Jr., has also been nominated to another term as AIME Vice President by The Metallurgical Society. He is general sales manager at the American Smelting & Refining Co. with which he has been associated since 1936.

## **Directors**

Edward G. Fox, SME President-Elect for 1962, will serve as Director representing the Society of Mining Engineers. (For biography see page





Norman L. Weiss has been nominated by the Society of Mining Engineers to serve as Director-at-Large on the AIME Board of Directors. A graduate of Massachusetts Institute of Technology, he is presently employed as milling engineer for American Smelting & Refining Co. in Salt Lake City.

H. B. Emerich has been nominated by The Metallurgical Society to serve on the AIME Board of Directors. He is presently director of technical services for Jones & Laughlin Steel Co. with which he has been associated since 1935. He attended the Carnegie Institute of Technology.

Douglas Ragland, engineering manager of Humble Oil Co.'s Humble Div. Production Dept., has been nominated by the Society of Petroleum Engineers as an AIME director. Mr. Ragland's association with Humble began in 1933, shortly after his graduation from Rice University. He is presently responsible for the direction of the company's Petroleum Engineering, Civil Engineering, and Gas Engineering divisions. The second AIME Director representing the Society of Petroleum Engineers will be the 1963 President of the Society. The SPE Nominating Committee will announce his name in the fall and he will begin his term as AIME Director in February 1962.

The Chairmen of the three Society Nominating Committees have announced nominations for AIME President-Elect, Vice Presidents, and Directors for 1962.

Each of the Society Bylaws provides for additional nominations. (The Bylaws of each Society in substantially final form have been published in the Journals and in revised form in the 1957 Institute Directory.) If no alternate slate is proposed, no letter ballot will be necessary and the selections of the three Nominating Committees will be declared elected in accordance with the respective Society Bylaws well in advance of their installation at the 1962 Annual Meeting in February in New York.

# NOMINATIONS FOR SME OFFICERS FOR 1962 ANNOUNCED



E. G. FOX

Edward G. Fox has been nominated President-Elect of the Society of Mining Engineers, to take office as President in 1963. Since 1956 he has been president of the Bituminous Coal Operators' Assn. which was organized in 1950 to carry on labor relations with the United Mine Workers of America. After attending Pennsylvania State University where he received a B.S. degree in Mining Engineering in 1924 and the degree of Engineer in Mining in 1925, Mr. Fox joined the J. G. White Corp. In 1926, he became associated with Madeira Hill and Co. as Assistant to the Superintendent at the Natalie Colliery, ultimately becoming General Manager of the company in 1936. Subsequently he joined the Colonial Collieries Co. as General Manager in 1937 and the Phoenix Contracting Co. as General Manager in 1943. In 1946, he assumed the presidency of Shen-Penn Production Co. and later became president of its parent company, Philadelphia and Reading Corp. The Pennsylvania State University awarded him the Distinguished Alumnus Medal in

Curtis L. Wilson, Dean of Missouri School of Mines and Metallurgy, has been nominated Central Regional Vice President for a three-year term. After being graduated from the Montana School of Mines in 1920, he worked as assistant research engineer for the Anaconda Copper Mining Co. In 1921, he joined the faculty of Montana School of Mines as an

instructor in metallurgy. Following graduate studies at Columbia University, he attended University of Goettingen in Germany from 1926 to 1928. Dr. Wilson returned to Montana School of Mines as Professor of Metallurgical Engineering and in 1941 he assumed his present position. A former member of the AIME Board of Directors, he has also been Chairman of the AIME Education Division and of the Montana and St. Louis Sections of the Institute.

Robert J. Lacy, 1960 Chairman of the Mining & Exploration Division and recently nominated as Director of SME, is Chief Geophysicist for American Smelting & Refining Co., Salt Lake City. After being graduated from the University of Minnesota in 1937, he began his career as a mine geologist for The Anaconda Co. in Butte, Mont. In 1946 he joined the California Co. in exploration work. After returning to the University of Minnesota in 1947 for graduate work, he assumed the post of geologist with his present company in 1948.

H. Rush Spedden is the Minerals Beneficiation Division nominee to the SME Board of Directors. He is Director of Research for Union Carbide Ore Co., New York City, and former Chairman of MBD in 1960. A graduate of the University of Washington and the Montana School of Mines, he went to MIT as research assistant in 1940. He took a leave of absence from this school two years later to serve as metallurgist with the U. S. Foreign Economic Administration in Bolivia. Following military service, Mr. Spedden returned to MIT in 1946 as Assistant Professor of Mineral Engineering. He subsequently joined Union Carbide in 1952, at the Metals Research Laboratories in Niagara Falls.

Seth K. Droubay, Vice President and General Manager of United Park City Mines Co., Salt Lake City, has been nominated by the Mining & Exploration Division as a Director of SME for a three-year term. He was graduated from the University of Utah in 1926 and immediately joined United Verde Copper Co. at Jerome,

Ariz. In 1933, Mr. Droubay became associated with the Mother Lode Gold Mines Inc. in California, subsequently moving to The Anaconda Co. in 1935. He served the latter company in California, Nevada, Oregon, Montana, and Utah before joining the United Park City Mines Co. in 1953. In his varied career, he has worked as a miner progressing through engineering and geology, serving as mine superintendent, manager, and general manager.

Carl F. Clausen, 1961 Chairman of the Industrial Minerals Division, has also been nominated for the SME Board of Directors. Dr. Clausen is Director of the Manufacturing Process Department, Research & Development Div., of the Portland Cement Association with which he has been associated since 1947. A native of Denmark but long a citizen of the U. S., he received his education at the Royal Polytechnical Institute of Copenhagen. During both World War II and the Korean War, he served as the representative of the cement industry on the War Production Board and the National Production Authority. Long active in SME affairs, Dr. Clausen participated in the recent 1st International Symposium on Agglomeration by serving on the Symposium Advisory Board.

Editor's Note: Nomination of one Director of SME by the Coal Division has not been made at this time. The biography of the man selected for this post will appear in a subsequent issue of MINING ENGINEERING.

Section 11 of Article IX, SME Bylaws, provides: "The names and blographies of the nominees shall be published in the July issue of MINING ENGINERISM.

Any 25 members of the Society may submit additional nominations to the Board of Directors for one or more of the positions specified ... President-Elect and one Regional Vice President.] Such nominations shall be submitted not later than September of that year [1961], and notice of the additional nominees for the position or positions designated shall then be published in the October issue of MINING ENGINERISM. ... If additional nominations are received a letter ballot for the positions shall be sent on or about November 1 to all voting members of the Society in the United States, Canada, and Mexico. Ballots shall be returned within 45 days after they are mailed."



C. L. WILSON



R. J. LACY



C. F. CLAUSEN



S. K. DROUBAY



H. R. SPEDDEN

# INDUS

# DUSTRIAL MINERAL NEWSLETTER









F. R. HUNTER



R. S. McCLELLAN



W. R. WAGNE



J. K. BROOKE

# Division Nominees for 1962

The Nominating Committee of the Industrial Minerals Division has prepared a list of nominees to take office, if elected, in February 1962. Lauren A. Wright has been nominated Chairman and Frank R. Hunter has been named to the post of Secretary-Treasurer.

Lauren A. Wright is Supervising Mining Geologist of the California Division of Mines which he has served since 1947. This fall Dr. Wright will assume the position of Professor of Geology at Pennsylvania State University. A graduate of the University of Southern California in 1940, he received his Ph.D. degree in 1951 from the California Institute of Technology. From 1942 to 1946, Dr. Wright worked for the U.S. Geological Survey before assuming his present position.

Frank R. Hunter is Chief Geologist of the Industrial Minerals Division of International Minerals & Chemical Corp. with which he has been associated since 1945. Dr. Hunter is a graduate of the University of Washington and Cornell University. Prior to joining his present company, he served three years as a geologist with Texaco Oil Co.

The Division selects several vice chairmen to represent seven designated areas of the U.S. and Canada.

Robert S. McClellan, Vice President of Gouverneur Talc Co., a subsidiary of R. T. Vanderbilt Co., will represent the Northeast Region. He has been in charge of several mines for R. T. Vanderbilt Co. by whom he has been employed more than 20 years. The Southeast will be represented by J. E. Monroe, Jr. who is Assistant Vice President of the Freeport Sulphur Co., New Orleans. James C. Bradbury, a geologist on the staff of Illinois Geological Survey, has been named to represent the Mid-Continent area. Warren R. Wagner, a consultant in Boise, Idaho, will represent the Rocky Mountain Region. The Pacific Southwest will be represented by W. F. Dietrich, Chief, Division of Mineral Resources, Region II, U.S. Bureau of Mines. The Canadian representative will be Richard A. Wyman, a member of the Department of Mines and Technical Surveys in Ottawa, (Editor's Note: At the time of this writing, nomination for Pacific Northwest Regional representative is still pending.)

The following members have been nominated to the Executive Committee: J. K. Brooke, Administration Engineer-Resources, Kaiser Aluminum Chemical Corp. A graduate of Stanford and Columbia Universities, Mr. Brooke has also served as Research Engineer for the Howe Sound Co. Thomas D. Murphy, Chief Geologist, Pennsylvania Glass Sand Corp. Mr.

Murphy attended both the Missouri School of Mines and Stanford University and has worked for the Columbia Quarry Co. and Industrial Silica Corp. Henry M. Woodrooffe, Supervisor, Industrial Minerals Subdivision, Minerals Branch, Ottawa, Canada. Mr. Woodrooffe has served as Research Engineer for International Nickel Co. and as Engineer at the Bureau of Mines.

Donald R. Irving and Richard H. Jahns have again been nominated to the SME Transactions Editorial Committee and SME General Editorial Committee respectively. Mr. Irving is Assistant Chief, Division of Mines, U.S. Bureau of Mines. Mr. Jahns is Professor of Geology, Division of Earth Sciences, Pennsylvania State University.

Division representatives nominated to the SME Nominating Committee are John G. Broughton, State Geologist, Geological Survey of New York, and John B. Graham, partner of Leggett, Bashears and Graham.

Dr. Broughton, active in the Division for many years, has served as SME Director and a member of the Executive Committee of the Industrial Minerals Division. Mr. Graham has served on the Industrial Waters Committee, been Vice Chairman representing the Northeast Region, and a member of the Division's Executive Committee. Alternates selected for the Nominating Committee are Frederick C. Kruger, Director of Mining & Exploration Department, International Mining & Chemical Corp., and Frank R. Hunter of the same company.



D. R. IRVING



R. H. JAHNS



J. G. BROUGHTON

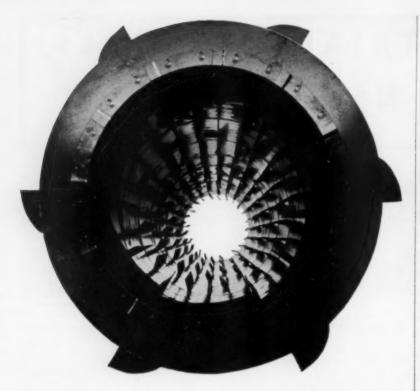


F. C. KRUGER

### **CIM-SME Ottawa Meeting**

Please see page 896 for more news of the CIM-SME meeting.

(Continued on page 900)



# ADAPTABILITY

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# Industrial Minerals Newsletter

(Continued from page 899)

### Notes on the Southwest Mineral Industry Conference

The Las Vegas meeting, sponsored by the Nevada Section of AIME, and with participation by the Southern California and San Francisco Sections, the Industrial Minerals Division of SME, and the Southern California AIME Metals Branch, held at the Stardust Hotel on April 24-25 was an outstanding success. After a pre-registration of approximately 150, attendance grew to over 400 with participants coming from all over the

country.

Credit for planning and executing the over-all policy and countless details is due Victor Howard, the Chairman of the General Administrative Committee, who was assisted by E. Don Dilling, L. Russell Wood, Edmond F. Lawrence, and R. R. Lloyd. The Program Committee was headed by William G. Flangas and included Fred Lohse, and J. K. Brooke, the 1961 and 1960 Pacific Southwest Vice Chairmen of IndMD. James F. Orr was Chairman of the Finance Committee; Frank E. Love, Arrangements Committee; Ernest H. Clary, Registration Committee; V. E. Scheid, Students' Affairs Committee; Leon R. Fayle, House Committee; and Lester J. Hartzell, Publicity Committee.

The excellent technical program included three industrial minerals sessions; two nuclear sessions, two geology sessions, and sessions devoted to extractive metallurgy, physical metallurgy, and mining. (For a more detailed report of these sessions see MINING ENGINEERING, June

1961 page 623.)

At the All Participants Luncheon on April 24 the Hon. Grant Sawyer, Governor of Nevada was guest of honor and spoke on current mining, economic, and legislative topics. R. R. McNaughton, AIME President, was speaker at the April 25 luncheon and described, in a most interesting lecture, the development and metallurgical activities of his company in British Columbia.

An interesting innovation was the Industrial Minerals Breakfast. Secretaries Kirkendall and Fox were guests of honor. It is rumored that technology really took a beating during breakfast deliberations!

The Ladies' Activities Committee, headed by Mrs. E. H. Clary, had arranged for the Hospitality Room, a luncheon-fashion show as well as participation in the cocktail party and the fabulous dinner show.

The Committees, participating sections, and technical authors are to be congratulated on one of AIME's most successful regional meetings.—
From report by Carl F. Clausen.



# ROCK IN THE BOX

# Mining & Exploration Division







R. W. MARSDEN



D. C. COOK



R. H. CARPENTER



R. M. STEWART

In accordance with the Bylaws of the Mining and Exploration Division, the Nominating Committee presents the following slate of officers to serve for the year beginning February 1962: J. M. Ehrhorn, Chairman; R. W. Marsden, Assistant Chairman; Douglas R. Cook, Vice Chairman in charge of programs; R. H. Carpenter, Vice Chairman for publications; and Richard Maclin Stewart, Vice Chairman in charge of membership. Nominated to serve as SME Board members are R. J. Lacy and S. K. Droubay (see page 898 for photographs and biographies).

Jack M. Ehrhorn, who has been serving as Assistant Chairman for the Division this year, has been nominated for the chairmanship. He is director of industrial development for U.S. Smelting Refining & Mining Co., with which he has been associated since 1944. A graduate of Stanford University from which he received his degree in mining engineering in 1927, Mr. Ehrhorn gained his early mining experience working as a miner, timberman, and shift boss with United Verde Copper Co. in Arizona, the North Fork Placer Mines at Helena, Calif., and the Idaho Maryland Mines Corp. in Grass Valley, Calif. In 1938 he went into partnership with H. F. Lynn as a consultant engineer and geologist. He worked for Western Knapp Engineering Co. for two years prior to joining U.S. Smelting Refining and Mining Co.

Ralph W. Marsden, manager—geological investigation for Oliver Iron Mining Div., U.S. Steel Corp., has been nominated as Assistant Chairman. A native of Wisconsin, he is a graduate of the University of Wisconsin, also earning his master's and doctor's degrees there. He worked as

geologist with the Wisconsin Geological Survey during the summers of 1934 to 1936 and 1938 and 1939. When World War II broke out he was geologist and chief, Geological Survey Group, Philippine Bureau of Mines, and was interned at Cebu, Santa Tomas and Los Banos from 1942 to 1945. In 1945 he joined Jones & Laughlin Steel Corp. as geologist, and except for a one-year period, 1946 to 1947, when he served on the staff of the University of Oklahoma as associate professor of geology, he remained with the firm until 1951.

Douglas R. Cook, nominee for Vice Chairman in charge of programs, is senior geologist for Bear Creek Mining Co. with which he has been associated since 1952. He came to Bear Creek as an exploration geologist after a year as an instructor at the Colorado School of Mines. Mr. Cook is a native of England and graduated from the University of Durham, England, in 1945 with a degree in mining engineering. He received his master's degree from the University of Toronto and his doctorate from the Colorado School of Mines. He worked for the Londonderry Collieries Ltd. in England, and from 1946 to 1947 was a junior mining engineer for Consolidated African Selection Trust Ltd. in Sierra Leone, West Africa. During the summers of 1948 and 1949 he served as senior geological assistant for the Ontario Department of Mines.

Robert H. Carpenter, nominated for the post of Vice Chairman in charge of publications, is professor of geology at the Colorado School of Mines where he has been a member of the faculty since 1947. In addition to academic activities he has been engaged in consulting work for the Thompson Creek Coal & Coke Corp.

and other clients. A native Californian, he graduated from Stanford University with both a B.A. and M.A. degrees in geology. He attended Princeton University for a year and later returned to Stanford University to obtain a PhD. degree in geology and mining. During 1957-58 he spent a year in Florence, Italy as a Fulbright Research Scholar carrying out research investigations of hydrothermal dispersion in carbonate rocks in south central Europe.

Richard Maclin Stewart, nominee for Vice Chairman for membership, is director of mining research at Butte, Mont. for The Anaconda Co. Since joining the company in 1948, working as a miner before undergoing Anaconda's supervisors' training course, Mr. Stewart has visited company operations in Chile, Canada, Latin America, and the U.S. He is one of the generation whose academic career was interrupted by World War II. He entered the Colorado School of Mines in 1940 and worked as a surveyor and miner during summer vacations. In 1943 he entered the U.S. Army Corps of Engineers and saw service in the European Theater, winning distinction in the Italian campaign. He returned to the U.S. in 1945 and resumed his studies at the Colorado School of mines, graduating with an E.M. degree in 1948. He is a registered professional engineer in the state of Montana.

# M&E DIVISION NEWS EDITOR Peter B. Nalle

Riverside Cement Co. Bax 832 Riverside, California







D. DAHLSTROM

The Minerals Beneficiation Division Nominating Committee has selected the following members as candidates for Division offices for the term beginning February 1962. Stephen E. Erickson has been nominated Chairman and Donald A. Dahlstrom Associate Chairman. Under the Division's Bylaws, Mr. Dahlstrom, as Associate Chairman, will head its Program Committee and will serve as a member of the SME Program Committee. He will also serve as an alternate on the SME Nominating Committee. Bunting S. Crocker has been named First Regional Vice Chairman and William T. Marston as Second Regional Vice Chairman, also as MBD representa-tive on the SME General Editorial Committee. Secretary Treasurer designate is Donald J. Drinkwater.

Stephen E. Erickson, who is presently serving the Division as Associate Chairman, is a beneficiation engineer with M. A. Hanna Co., Hibbing, Minn. A native of Minnesota, he attended the University of Minnesota School of Mines, where he received a degree in metallurgy.

Donald A. Dahlstrom, the Associate Chairman nominee, is director of the research and development department of Eimco Corp., a position he has held since 1953. A graduate of the University of Minnesota, he received his Ph.D. from Northwestern University where he was a faculty member for ten years.

Bunting S. Crocker, slated to serve as First Regional Vice Chairman, is vice president of Kilborn Engineering Ltd. Before joining Kilborn, he worked for Lake Shore Mines Ltd. A native of Toronto, he is a graduate of the University of Toronto.

William T. Marston, who has been named to serve as Second Regional Vice Chairman, is area manager of industrial sales for Dorr-Oliver Inc., a position he has held since 1957. He



joined the company following his graduation from the University of Toronto in 1949.

Secretary-Treasurer designate for a two-year term is **Donald J. Drink**water. He is manager of the manufacturing division of The Mine & Smelter Supply Co., a position he has held since the latter part of 1958. He is a graduate of the Colorado School of Mines.

Committee chairmen have also been proposed for the coming year by the Nomination Committee. W. B. Stephenson, SME President, has been chosen to head the Nominating Committee. (see page 897 for picture and biography). Roy A. Johnson will complete his two-year term as Membership Chairman and continue to serve as MBD's representative on the SME Membership Committee.

E. J. O'Connell, executive assistant, Western Knapp Engineering Co., has been proposed as Chairman for Materials Handling and Storage.

R. J. Russell, executive vice president of Hardinge Co. Inc., has been chosen to head the Crushing and Grinding Committee. Solid Fluid Separation will have as its head W. C. Mason, sales engineer, International Div., Dorr-Oliver Inc.

J. R. Moore, assistant general superintendent, The Anaconda Co., has been named Chairman of the Concentration Committee. C. H. Curtis, assistant resident manager of the Copper Div., Duval Sulphur & Potash Co., has been named to head Operating Control. Chemical Process will be under the direction of W. H. Dresher, Metals Research Laboratory, Union Carbide Nuclear Co.

J. E. Stukel, operations metallurgist for Cleveland Cliffs Iron Co., will be responsible for the Pyrolysis and Agglomeration Committee. Frank J. Windolph, assistant general superintendent, Climax Molybdenum, will complete his two-year term as head of Mill Design. D. W. Fuerstenau, associate professor of metallurgy at the University of California, has been nominated as Chairman of Basic Science. D. W. Mitchell, director of research, Foote Mineral Co., has been named Chairman of MBD's Education Committee and will automatically become a member of the SME Education Committee. Oscar Tangel, chief of Minerals Beneficiation Div., Battelle Memorial Institute, finishes his second year of a two-year term as head of the Papers and Publications Committee and will continue to serve as a member of the SME Transactions Editorial Committee.

Further nominations include representatives for SME positions. H. Rush Spedden, director of research for Union Carbide Ore Co., has been nominated director (see page 898 for photograph and biography). He has also been named to the Nominating Committee as principal member along with N. Plummer, superintendent of the Arthur plant, Kennecott Copper Corp., and this year's Divisional Chairman. R. J. Middlekauf, vice president of The Middlekauf Corp. will serve again on the Admissions Committee along with newly chosen R. B. Brackin, manager of columbium properties for Kennecott Copper Corp. N. Arbiter, professor of mining engineering, Columbia University, has been nominated to the Mineral Economics Committee.



B. S. CROCKER



W. T. MARSTON



D. J. DRINKWATER



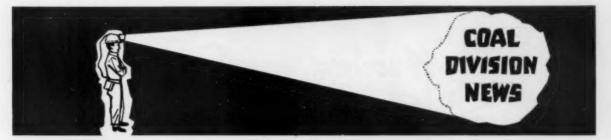
R. J. RUSSELL



J. R. MOORE



D. W. MITCHELL









Heading the slate of candidates submitted for the elective offices of the Coal Division by the Nominating Committee is Earl R. McMillan, nominee for Chairman-Elect. George E. Keller and Julian E. Tobey, Jr., have also been nominated for the positions of Secretary-Treasurer and Secretary - Treasurer - Elect, respectively. The latter position is a new innovation in the Division, and the person elected to this "office" will assume the duties of Secretary-Treasurer in 1963.

Earl R. McMillan, nominee for Chairman-Elect of the Coal Division, will, if elected, become Chairman of the Division in 1963. Mr. McMillan, now Manager of Coal Operations and Chief Engineer of the Coal Department of the Northern Pacific Railway Co., is a graduate of the University of Missouri (1917) and of the University of Washington (1918). From 1919 to 1923, he was with the U.S. Bureau of Mines in Seattle. He spent five years as a consulting mining engineer in the Northwest before joining a subsidiary of the Northern Pacific Railway Co. in 1929. Mr. McMillan has also served as Chairman of the North Pacific Section of AIME.

George E. Keller, presently Secretary-Treasurer of the Coal Division, has been renominated for another one-year term. A graduate of the University of Illinois with a chemical



engineering degree, he was with Commercial Testing & Engineering Co. for 30 years, becoming a branch manager and chemical director. In 1954 he joined U.S. Steel Corp. as Manager-Coal Evaluation, a position he still holds. He is a former chairman of the Central Applachian Section of AIME and has also served as Program Chairman of the Division and as a member of the Executive Committee.

Julian E. Tobey, Jr., nominee for Secretary-Treasurer-Elect, is Secretary and Manager of the Mid-West Coal Production Institute in Chicago. He began his career as a research engineer with Battelle Memorial Institute in 1946. Four years later he joined Blue Diamond Coal Co. as Industrial Sales Engineer, and in 1955 he became Director of Engineering with Indiana Coal Assn. He is serving on the 1961 Joint Solid Fuels Conference Planning Committee and is Chairman of the Percy Nicholls Award Committee.

The three men who will assume the duties of Representatives of the Coal Division of the Executive Committee are George L. Judy, Ernest M. Spokes, and James A. Younkins, Jr. Their three-year term of office will begin in February 1962.

George L. Judy joined E. I. du Pont de Nemours & Co. shortly after his graduation from West Virginia University in 1942. He moved to Moun-



taineer Coal Co. (subsidiary of Consolidation Coal Co.) in 1945 as Assistant Division Maintenance Su-perintendent. In 1953 he became Vice President of Mountaineer Coal Co., and in 1960 he transferred to the Christopher Coal Co. as Vice President of that firm.

Ernest M. Spokes, Professor of Mining Engineering at University of Kentucky, is also a director of SME. He took his academic training at Lafayette College, University of Kentucky, and Pennsylvania State University. From 1936 to 1940, he was a mining engineer with the Bethlehem Steel Co. After his return from service in the U. S. Army during World War II, he joined National Lead Co. at their Tahawus operations where he ultimately became General Engineer. He has been on the faculty of the University of Kentucky approximately 12 years.

James A. Younkins, Jr., is Assistant General Superintendent of the Coal Department of Duquesne Light Co., Pittsburgh. A graduate of Pennsylvania State University and Carnegie Institute of Technology, he joined Pittsburgh Coal Co. as a chemist in 1927. In 1940 he became associated with his present company as an assistant engineer. Among his other activities, he has served the Coal Division as a former Chairman of the Publications Committee and of the Program Committee.

David R. Mitchell, now serving as Chairman-Elect, will become Division Chairman in 1962. He is presently associate dean of the College of Mineral Industries, Pennsylvania State University. A graduate of the university, he returned in 1938 as a member of the faculty. From 1924 to 1926 he served as an engineer with the Bethlehem Mines Corp. and from 1927 until his return to Penn State he was a member of the faculty of the University of Illinois. Since taking a post at Penn State, he has been able to carry on a limited consulting practice.

> COAL DIVISION NEWS EDITOR RAYMOND E. DAWSON

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# Around the Sections





Members and guests of the Tucson Subsection enjoy cool evening breezes on the patio of the Cliff Manor hotel during the social hour.

- A gathering of 100 members, guests, and students from the University of Arizona met at the Cliff Manor Motor Hotel for the Tucson Subsection (Arizona Section) meeting on May 10 to hear an illustrated talk entitled Rocky Mountain Tunnels by Thomas W. Mitcham, consulting geologist and professor at the University. Among the projects discussed were the famous Moffitt and Roberts tunnels. The talk stimulated the group to raise many questions concerning the projects.
- What is believed to be the Midwest's first concentrated effort to inform and stimulate high school students about mining and metallurgy by AIME members, was undertaken May 18 by the Wisconsin Section. A group of Milwaukee area students interested in engineering, were invited to view the laboratory facilities in the mining and metallurgical building on the University of Wisconsin campus. It has been recognized by the Wisconsin Section that there is a growing shortage of stu-

dents entering these fields. The professors confirmed the fact that a shortage exists at Wisconsin, which is also true in other parts of the nation, Members in the two fields believe one of the reasons for the shortage is due to the lack of stress on mineral engineering by the guidance counselors in the high schools. Following the tour, the students

Following the tour, the students attended the society meeting held in the building. Philip Rosenthal, head of the Mining and Metallurgical Dept., introduced his colleagues, who explained their particular areas of teaching and research, to the students. They included R. W. Heine, D. J. Mack, L. D. Clark, F. H. Vitovec, T. D. Tiemann, R. A. Dodd, R. Nelson, and Carl Loper, Jr.

A dinner was held at the Cuba Club in the evening. Chairman T. G. Kirkland acted as host, and Robert Marshall, associate dean of the College of Engineering, was guest speaker. Dr. Marshall told the group about the latest equipment available to engineering students and the newest concepts in class instruction, such

as computing machines and tape recorded lectures.

It was decided by the Section members and professors to sponsor student trips on a yearly basis.

- Well over a hundred people attended the May 10 meeting of the San Francisco Section at which Ronald R. McNaughton, AIME President, was guest speaker. His subject was The Extractive Metallurgy of Lead, Zinc, and Silver. The meeting was held at the Engineers' Club with Evan Just presiding.
- Informality and conviviality were the order of the evening, when members of the Ajo Subsection (Arizona Section) and the WAAIME's gathered at Denison's Picnic Grounds for a potluck supper on May 11. Soft drinks and a keg of beer were available; each family provided its own meat; and the WAAIME's provided the potluck.
- The Student Chapter of the University of Washington reported on



Students Paul Ramsey, right, and Warren Gerds hear about the microhardness testing apparatus from Philip Rosenthal of the University of Wisconsin's Dept. of Mining and Metallurgy.



Guest speaker at the Wisconsin Section dinner was Robert Marshall, standing. Seated at the head table with him were from left: R. A. Dodd, Philip Rosenthal, and Will Mitchell.

their activities for the year. It had actively participated on the Engineering Student Council; presented a slide show on mineral exploration for the freshman engineering stu-dents; prepared and delivered the January program for the North Pacific Section of AIME; written an article on mining engineering for the university engineering publications; and held 14 meetings. At the meeting on April 27, new chapter officers were elected as follows: Jeffery M. White, chairman; Michael D. Mc-Cleary, vice chairman; John D. Norgord, secretary-treasurer; John U. Rudin, junior representative to Engineering Student Council; and Willis K. Beach, senior representative of Engineering Student Council. On May 11 a film on the Russian fuel industry was featured at the meeting. and on May 18 the Chapter attended the North Pacific Section meeting.

- · A regular dinner meeting of the Colorado Section was held at the Petroleum Club in Denver on April 20. A total of 54 members attended including one speaker and three student guests. Chairman, Al Hoyle presided over the meeting. A number of announcements were made including invitations to MBD annual meeting in Colorado Springs, the Engineers Manpower Conference, and Engineers Day at the University of Colorado. The motion was made, seconded, and passed to dispense with the reading of the minutes of the March meeting. Mr. M. G. Mc-Grath of Stearns-Roger Manufacturing Co. spoke on the Development of a New Kaolin Producer.
- Ben Harrison, assistant auditor, U.S. Pipe & Foundry Co., was the principal speaker at the April 20 meeting of the Southeast Section held at the Thomas Jefferson Hotel in Birmingham, Ala. His topic was Taxes and Management, and in the course of his talk he stressed the necessity for everyday cooperation on tax matters between management, operating personnel, and the tax administrators. He also gave several practical examples to illustrate the influence and importance of tax planning on management decisions.



Ben Harrison, left, speaker at the Southeast Section meeting with J. W. Nicol.



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### Around the Sections

Continued

• Members of the Utah Coal Section played host to Mr. and Mrs. R. R. McNaughton, E. O. Kirkendall, and C. J. Hicks at a social and dinner meeting April 29. Mr. Kirkendall and Mr. Hicks spoke briefly about services and functions of AIME. R. R. McNaughton, AIME President, talked about American-Canadian relations, leaving the group with a more comprehensive understanding of our northern neighbors.



- Washington D.C. Section meeting May 16 featured a talk entitled Research Investigation at the USGS Hawaiian Volcano Observatory by K. J. Murata, geochemist with the Survey. He was scientist-incharge of the Observatory during the 1959-60 eruptions of the Kilauea Volcano and his talk featured a report of scientific studies made before, during and after the eruptions. It was illustrated by color movies and slides showing one of nature's most fantastic displays. As usual the meeting was held at the Broadmoor Apartment Hotel.
- Members of the Adirondack Section made a tour of the surface facilities of the International Talc Co. Poplar Hill mill at their May 27 meeting. Following the tour, there was a symposium on labor contracts and their pitfalls. Paul Goggi, of Goggi and Race, management consultants, participated in the symposium and spoke at the dinner meeting which was held at the Gouverneur Country Club.



Pictured at the Utah Coal Section meeting on April 29 from left to right are: Lunn Huntsman, John Peperakis, Joseph T. Taylor, Clifford J. Hicks, Ronald R. McNaughton, Joseph B. McKean, Ernest O. Kirkendall, and Robert M. von Storch.

Anderson-Carlisle Society (Student Chapter of the Montana School of Mines) sponsored Engineering Days, April 15 and 16, at the University in conjunction with the entire student body. Various departments scheduled demonstrations and exhibits, accompanied by appropriate lectures, to acquaint the visiting public and high school students with the educational facilities available at the Montana School of Mines. A variety of technical movies was also presented. Attendance at the twoday event was over 1200. First place honors for the most effective overall program went to the Minerals Dressing Dept.; the Metallurgy Dept. and the Physics Dept. tied for second place.

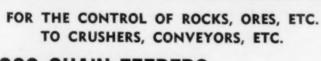
On May 14 the Society held its annual picnic, and on May 24 held a joint meeting with the Montana Section at which the speaker, procured by the Anderson-Carlisle Society, was Donald G. Nutter, Governor of Montana.

• The Mexican Section held its monthly meeting May 8 at the University Club in Mexico City. The meeting featured a talk entitled Notes About the Tectonic History of Mexico by Eduardo J. Guzman, as-

sistant manager of the exploration department of Petroleos Mexicanos, who was assisted in his presentation by Zoltan de Czerna, geologist. Questions from the floor followed the talk

· The University of Minnesota Stuent Chapter has completed a successful year of meetings and participation programs. Some of the memorable events of the year were: the winning for the fourth consecutive year the All-Participation Trophy at the Annual Engineers' Day Celebration of the University of Minnesota Institute of Technology: the annual spring banquet at which members of the Minnesota Section were guests along with Jack C. Fox, SME Secretary and E. W. Davis, consultant for the Reserve Mining Co., and speaker of the evening; and attendance of the Chapter members as guests of the Minnesota Section at their annual meeting in Duluth in January. A total of five meetings were held during the year at which technical subjects were discussed.

(Continued on page 912)



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E. W. Davis addresses University of Minnesota Student Chapter spring banquet.

# Personals







R. D. ELLETT



J. C. RUSSELL



ROMAN CHELMINSKI

George E. Kruger has been promoted to vice president of the Chase Manhattan Bank. Mr. Kruger joined the bank in 1957 as a mining geologist in the petroleum department and was named technical director, mining industry, in 1960. Prior to 1957 he worked as a consulting mining geologist in South America and New York.

Richard D. Ellett, formerly foreign exploration geologist for Utah Construction Co., has been sent to Australia as overseas manager of mineral development of Utah Development Co. in charge of an extensive mineral development program there.

After five years as senior research associate with Resources for the Future Inc., Bruce C. Netschert has left to become director of the Washington office of National Economic Research Associates.

Michael P. Mehan retired April 1 after 19 years in government service. The last four years he served as chief for concentrates procurement with the AEC in Grand Junction, Colo. He is now making his home in Tucson, Ariz.

John T. Sherman, formerly assistant director for domestic procurement, Div. of Raw Materials of the AEC, has joined the Atomic Industrial Forum staff as mining and milling projects manager. The Forum's Committee on Mining and Milling is supported by a number of the major uranium ore and concentrate producers. Its objective is to foster a healthy uranium industry, and to assure a continuing supply of uranium at reasonable cost to meet the requirements of both government and private industry.

After four years with Utah Construction & Mining Co. in its uranium and iron programs, Ruffin I. Rackley has been transferred to Salt Lake City to direct the coal and industrial minerals group of the Mineral Development & Geology Dept.

Singmaster & Breyer recently announced the election of John C. Russell and Roman Chelminski to partnership in the firm. Mr. Russell is manager of mining and metallurgy for the company and has been associated with the firm since 1955. Prior to that he had been active for some 18 years in the non-ferrous metal production industries here and abroad. Mr. Chelminski came to Singmaster & Breyer in 1959 from Knowles Associates, where he was a senior partner for 12 years. His earlier experience included 14 years with the Dorr Co. as technical manager of European subsidiaries.

George A. Lamb, new director of the Office of Coal Research, National Coal Assn., was recently awarded an honorary membership in Beta Gamma Sigma, commerce school honor society, West Virginia University. Mr. Lamb was nominated for the honor while he was still manager of business surveys for Consolidation Coal Co.

Harvey E. McCann is currently employed as a mining engineer with the Conservation Div., Mining Branch of USGS with offices in Salt Lake City.

W. H. Bradford recently resigned from his position as research engineer with General Electric Co. in Erith, England to take a post as ore dresser with the Federal Ministry of Mines and Power in Nigeria.

W. L. Parks has resigned as general manager of Cia. Minera Castano Viejo, S.A., Argentina, and is now living in Rialto, Calif.

Charles B. Bradford, formerly electrical engineer for the Ray Mines Div., Kennecott Copper Corp. in Hayden, Ariz., has joined Kermac Nuclear Fuels Corp. of Grants, N.M., as chief electrical engineer.

Earl O. Tergerson has recently returned to the U.S. after serving two and a half years as projects manager

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# personals

continued

for Utah Construction & Mining Co. in Korea. He acted as project manager and consulting metallurgist for the Korea Tungsten Mining Co.'s scheelite refinery project at the famous Sang Dong mine. In addition he served as manager of a Utah/ICA diamond drilling and geological advisory contract with various Korean mining companies engaged in mining coal and iron ore.

After serving as a research fellow in geology at Harvard University, Gabor Dessau has returned to Pisa, Italy to resume his post with the Istituto Geologia Universita.

After seven years as technical director for W. H. Muller S.A., in Brazil, R. van Nordheim has returned to the company's head office in Holland to take a position as a mining engineer.

The American Society for Engineering Education recently elected new officers as follows: Robert W. Van Houten, president; George A. Marston and Curtis L. Wilson, vice presidents



AD BY

J. FOX R. C. BRO

idents; and Wendel W. Burton, treasurer.

In a series of top-level reassignments, Dorr-Oliver Inc. recently announced the election of William J. Fox, vice president of domestic op-erations to the board of directors; his resignation as secretary of the corporation; the resignation of G. H. Dorr II as treasurer; the election of Rowland C. W. Brown to replace Mr. Fox as secretary; and the appointment of Glen G. Reed, a vice president, to the newly created post of vice president of the international division. In addition to his duties as secretary, Mr. Brown has temporarily assumed the duties of treasurer, and it is expected that he will be confirmed as secretary-treasurer in the near future.

Walter E. Heinrich, Jr., president and general manager of Heinrichs Geoexploration Co., Tucson, Ariz., recently returned from a trip to South America and the Caribbean islands.





investigating geological-geophysical, economic water, and other mineral problems in Peru, Panama, and Puerto Rico.

After a several months stay in England following his return from South America, Michael E. Woakes has has moved to Toronto, Canada to take a position with Radione Uranium Mines, Ltd.

International Minerals & Chemical Corp. recently announced the transfer and promotion of Allan Stoutenger from mine engineer to the industrial engineering department.

M. I. Signer, Jr. has joined U.S. Borax & Chemical Corp. in Carlsbad, N.M. as a senior mine engineer. He was formerly western phosphate project manager for International Minerals & Chemical Corp.

Personnel advancements at the Reserve Mining Co., Silver Bay, Minn. were announced recently by the manager of the taconite company's Babbitt Div. Sidney C. Howell, for-merly manager of the northern ore mines district of Republic Steel Corp., has been appointed staff assistant to the manager of the Babbitt Div. Matthew R. Banovetz has been transferred to the Silver Bay Div. to become assistant superintendent of the pelletizing department. He was formerly superintendent of the mining department. Raymond J. Bertie has been appointed assistant superintendent of the mining department, Babbitt. He joined the Reserve organization in 1951 and became staff mining engineer in 1955. Joseph Pastika, Jr., mining engineer, succeeds Mr. Bertie as staff mining engineer at Babbitt. He has been with the company since 1953.

At a recent Board of Directors meeting of Atlas Copco Inc., Howard C. Sheperd was named Chairman of the Board: Peter Redpath was elected president; C. E. Burton was named executive vice president; and R. G. Chambers was appointed vice president in charge of the Eastern Div. Mr. Redpath, formerly vice president of sales for Canadair, a subsiddiary of General Dynamics, has long been associated with the Atlas Copco Group through his directorship in Atlas Copco Canada. Mr. Burton, formerly vice president of Atlas Copco Pacific, was named executive vice president for the new organization which was formed early this year by merging Atlas Copco Eastern and Atlas Copco Pacific. Mr. Cham-



bers came to the U.S. organization after ten years with Atlas Copco Canada where he most recently served as western superintendent in Vancouver.

Clifford R. Nichols has been named mine safety engineer for the California State Div. of Industrial Safety to cover Santa Barbara and San Luis Obispo counties. Prior to accepting his present post, Mr. Nichols was mine superintendent for the Diamond Springs Mine Co.

Gordon E. Cofield, after five and a half years as district manager of midwestern sales for the WEMCO Div. of Western Machinery Co., has been transferred from Hibbing, Minn. to the company's San Francisco office as assistant manager of the process equipment department.

International Minerals & Chemical Corp. recently announced the appointment of S. A. Scott as chief mining engineer and Frank C. Pickard as manager of prospect development in the Mining and Exploration Dept. Other appointments were Donald H. Freas as geologist and David M. Williams as mining engineer. Scott will continue to act as shaft sinking superintendent at IMC's Esterhazy, Saskatchewan potash project until completion. Pickard has been project engineer at the Esterhazy development for the past four years. Freas was a geology professor at Arizona State University before joining IMC in his present position. Williams came to IMC after spending six years with Rio Algom Uranium mines

F. L. Evans, formerly assistant manager of Union Carbide Metals Co.'s Niagera Falls plant, was recently appointed manager of the plant, succeeding the late W. W. Heilman. He has been associated with the Company since 1940.

Eastern Gas & Fuel Associates recently announced five personnel changes in the engineering department of its Coal Div. R. L. Llewellyn, formerly preparation engineer, has been named manager of preparation and will also have general supervision of the company's Product Control Dept. Edgar Nash, formerly preparation engineer for the High Volatile Coal Div., has been promoted to product control manager, and Curtis L. Burgess, who had been promoted to product control super-visor in the High Volatile Div. In the company's Low Volatile Coal Div., Joseph T. Heatherman, former division preparation engineer, has been named product control supervisor, and Joseph C. Basile, has been promoted from preparation engineer to product control supervisor for the company's northern division.

Aero Service (Bahamas) Ltd., a subsidiary of Aero Service Corp., Philadelphia, has announced the appoint-



CHARLES MECH



WM. DESLAURIER

ment of Charles Keck and William DesLaurier as vice presidents of the new company. Mr Keck, who has been a technical representative of the worldwide air survey company in the Middle East since 1954 has his headquarters in Beirut. Mr. DesLaurier, who has represented the company in Europe and Africa for the last four years, makes his headquarters in Madrid.

Oglebay Norton Co. recently announced some organizational changes effective May 1. Renold D. Thompson was appointed assistant to the president. He has been executive assistant since 1959. Geroge F. Kisker, who has been in charge of the company's coal sales office in Cincinnati, has been transferred to the Cleveland office as director of coal sales. Walter B. Nichols, who assisted Mr. Kisker in the Cincinnati office, has also been sent to Cleveland where he is to serve as manager of metallurgical coal sales.

According to a recent announcement from the General Electric Co., Robert B. Moore has been appointed manager of process industries sales and engineering, and will be responsible for the integration of sales and engineering work for products and systems requiring special or unusual effort in this market area. He will represent the company to markets such as mining, materials handling, cement, glass, petroleum, chemical, and pipeline. He joined the company in 1940 immediately after graduation from Vanderbilt University. Prior to his new appointment, Mr. Moore was manager of mining, materials handling, and electrolytic processes engineering for the industrial sales operation of G. E.

The board of directors of Old Ben Coal Corp. recently announced the election of R. B. Starek from vice president—sales to senior vice president; D. P. Buchanan from manager to vice president—industrial sales; W. C. Campbell from assistant to the president to vice president; and R. E. Exum of by-product coals to vice president—industrial sales. The board also appointed Eugene T. Moroni, formerly assistant to the vice president, manager of mines.

Paul L. Cloke, assistant professor of geology at the University of Michigan has recently been appointed to serve on the education committee of the Geochemical Society.

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# personals

continued

After three years as mine foreman with Cerro de Pasco Corp. in Peru, L. A. Quiñones, has taken a position as production superintendent for Kermac Nuclear Fuels Corp. in Grants, N. M.

B. B. Nizio, formerly a consulting engineer, recently became a senior engineer with Henry J. Kaiser Co. (Canada) Ltd. upon his return from Caribbean countries where he had been engaged in consulting work.

Walter Riethmeier a senior engineer with Westen Knapp Engineering Co. has been transferred from California to Hibbing, Minn.

David LeCount Evans, consulting geologist, has terminated his association with Kornfeld International of Tulsa, Okla. He will continue to maintain headquarters in Wichita, Kan. from which he will provide services in midcontinent oil exploration and domestic and foreign mining evaluation.



C. J. KIRKLAND



H. W. BAJAK

Henry W. Bajak and Claude J. Kirkland have been elected as vice presidents of Arizona Chemical Co. which is jointly owned by American Cyanamid Co. and International Paper Co. Mr. Bajal, formerly general sales manager, will serve as vice president in charge of domestic sales while Mr. Kirkland, formerly manager of manufacturing, will assume his new role as vice president in charge of manufacturing.

Leslie E. Dick has retired from Oliver Iron Mining Div., U.S. Steel, as mine superintendent, after 15 years of service with the company. He has established an office in Madison, Wis., where he will carry on independent consulting work.

E. Willard Berry, professor of geology at Duke University, left May 28 for Malaya, where he will serve as visiting professor of geology for seven months at the University of Malaya in Kuala Lumpur under a grant from the Smith-Mundt Act.

The following officers were elected at the 33rd annual meeting of the Lead Industries Assn.: Jean Vuillequez, American Metal Climax Inc.,—President and chairman of the board of directors; Joseph A. Costello, The Ethyl Corp.—vice president; Charles R. Ince, St. Joseph Lead Co.—vice president; Simon D. Strauss, American Smelting and Refining Co.—vice president; and Robert L. Ziegfeld continues as secretary-treasurer.

Colin Campbell, business manager of the Society of Exploration Geophysicists, has been elected vice-president of the Council of Engineering Society Secretaries. Charles S. Doerr, executive secretary of the Engineers' Club of Philadelphia, has been elected president.

August J. Breitenstein, assistant vice president-raw materials, U.S. Steel Corp., is one of five graduates of the Ohio State University College of Engineering to be named to receive the 1961 Distinguished Alumnus Awards in recognition of his achievements in engineering research and related industrial and professional activities. He has been associated with U.S. Steel since 1941. In 1954, he was appointed director of exploration and planning, a position in which he administered the world-wide exploration activities of the corporation. He assumed his present position last February.



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W. H. NEWTON

T B COUNSELMAN

William H. Newton has recently been appointed to head the newly created Projects Dept. of WEMCO, a division of Western Machinery Co. Mr. Newton and his group will specialize in the design, engineering, and installation of complete WEMCO equipment packages and processing systems for the minerals, coal, chemical, and other processing industries.

Theodore B. Counselman, past vice president and director of AIME, consulting metallurgical engineer, and secretary-treasurer of Behre, Dolbear & Co., was awarded Columbia University's Alumni Medal for "service of exceptional merit" to the University and to the School of Engineering at the Commencment Day exercises on June 6.

Solomon Lieb, mining and metallurgical consultant, is currently on an extended tour in the Far East examining mining prospects for the Coronado Corp. He expects to spend

29 West 39th Street, New York 18, N. Y.

Old Address

most of his time visiting tin properties in Malaya and intends to visit Indonesia as well as other tin producing countries.

According to a recent announcement from Copper Range Co., John Robert Van Pelt, president of the Michigan College of Mining and Technology, was elected to the company's board of directors.

J. E. Van Stone has been appointed Cleveland district manager for Hewitt-Robins Inc. with responsibility for the marketing of conveyormachinery, power transmission equipment, and industrial rubber products in the area. He was formerly in charge of sales in the Salt Lake City area.

Denver Harris has been appointed special process engineer for American Potash & Chemical Corp.'s new manganese metal plant at Aberdeen, Miss. He will be temporarily assigned to the company's Henderson, Nev. plant.

Howard W. Dennison has been appointed factory sales representative in three southwestern states for R. G. LeTourneau, Inc. He will handle sales of the company's line of Pacemaker earthmovers and other heavy mobile equipment for the construction and mining industries. Mr. Dennison's work in the field of heavy

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# personals

continued

machinery spans thirty years, principally in the western states. He will be responsible for equipment sales in southern Calif., Ariz., and N.M.

Samuel G. Lasky has been appointed assistant director of the Department of the Interior's newly organized Office of Coal Research. Mr. Lasky is a nationally known engineer, geologist, and author. He received an E.M. from the Colorado School of Mines, an M.S. in geology from Yale, and graduated from the Industrial College of the Armed Forces. In 1931, Mr. Lasky joined the Department's Geological Survey as a field geologist and rose to positions as regional geologist, and chief of a national mineral resource appraisal branch. In 1951, he transferred to the Office of the Secretary where he served until this appointment.

Merle H. Guise, exploration engineer of Palm Springs, Calif., wrote us his impressions from prospecting around the Lake George District, Park County, Colo., succinctly terminating: "Beryllium, like uranium is found everywhere. But dividend

checks from mining it are mighty rare."

Norman C. Williams has submitted his resignation as professor of geology at the University of Utah to devote full time to his duties as vice president and chief geologist of Beryllium Resources, Inc. Dr. Williams has recently outlined deposits of beryllium ore in the Topaz area of southwestern Utah. In his letter of resignation, Dr. Williams said, "Beryllium is of great significance to our nuclear, space, and missile programs and has become of major importance in the national defense."

Election of E. F. VanderStucken, Jr. as a director of Texas Gulf Sulphur Co. was announced at the annual meeting of stockholders. Mr. VanderStucken had resigned as vice president and secretary of the company in January 1961. He joined the company in 1936 and served as secretary from 1955 and as vice president from 1957. He has been retained by the company as a consulting attorney.





N. C. WILLIAMS E. F.

E. F. VANDERSTUCKEN

# **Around the Sections**

(Continued from page 906)

The Chapter enrolled 31 new members this year.

• The regular quarterly meeting of the **Philippine Section** was held February 17, at the Town's Tavern, Manila. The meeting, in the form of a dinner session restricted to members only, included the showing of two motion pictures: *Uranium Mining*, courtesy of Union Carbide and Chemical Co., and *U.S.S. Nautilus Around the World*, courtesy of U.S. Information Service.

The meeting was highlighted by the election of officers and directors. C. E. Fertig and H. A. Gapud were elected chairman and vice-chairman respectively, and D. A. Smith was elected secretary-treasurer. The directors of the section for the forth-coming year are: E. Biel, R. W. Crosby, C. A. Mitke, J. W. Pickard, and W. R. Thomeyer.

Among the accomplishments of the section, chairman Fertig reported that the section showed a growth in membership of 22 members during the year. The chairman noted with pleasure that 48 of the 102 members are Filipinos. Indicative of the interest and activities of the SME members in the Philippines, during the past year, four well-attended meetings were held. Two of these were held in the city of Baguio and two in the city of Manila.

# What Nagle Pumps are doing for Minnesota Iron Mines they can do for you!

Many iron ore mining and processing firms in Minnesota have long and successfully used Nagle Pumps for drainage, ore washing and tailings handling. Mine operators find that Nagle Pumps require far less maintenance, but are easier to maintain when that occasion arises. A Nagle 4" type "CWO-C" cantilever shaft pump at Hibbing is shown top right; a 4" "CWO-C" at Coleraine, Minn., at right; and a 6" type "TR" handling 5% iron ore solids at Virginia, Minn., shown below. Send for Nagle Pump Selector today. Nagle representatives in all key mining areas.









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# **Obituaries**

George T. Gillison (Member 1949) died recently at the age of 64. He was a native of Illinois. Throughout his career he was associated with the coal industry beginning as transit-man for U.S. Fuel Co. in 1919 following his service in World War I. He remained with the company until the end of 1936 when he became resident engineer for the Illinois Division of Highways. That same year he joined Frick Coke Co. as mechaniza-tion engineer. In 1946 he went with U. S. Coal & Coke Co. as mine inspector, later becoming ventilation engineer. In the early 1950's Mr. Gillison joined U.S. Steel Co. as ventilation engineer in its coal division, remaining there until shortly before his death.

Claude L. Holloway (Member 1956) was killed in a coal mine accident March 23, 1961. He was born in Bethel Springs, Tenn., on Aug. 14, 1922 and attended Louisiana State University. Following graduation he went to work as industrial engineer at the Edgewater mine, TCI Div. of U.S. Steel Co. In 1955 he became assistant mine foreman, and at the time of his death he was foreman.

## **Obituaries**

(Continued from page 912)

Alfred J. "Fred" Cayia

An Appreciation by A. W. Heitman

Few men have been as widely known and respected in the mining circles of the Lake Superior District during the past 40 years as our good friend and associate, Alfred J. "Fred" Cayia. Throughout the state of Michigan and the mining districts of Minnesota and Ontario, his many friends and business acquaintances were saddened by Fred's death on April 2, 1961, just four years after his retirement. Those of us who worked closely with him through the years and enjoyed the usual warmth of his personality and the enthusiasm and energy with which he applied himself to the various projects under his direction, will long be inspired by the remembrance of this association. His was a code of hard work and determination to overcome any problem, however difficult, but not to the exclusion of a delightful ability to relax and share with his subordinates the enjoyment of a well-completed task. The development and encouragement of younger men who were under his supervision was most successfully achieved through his strong but modest, almost selfeffacing leadership.

A member of a pioneer Upper Michigan family, Fred grew up with his many brothers and sisters in Crystal Falls, Mich. Iron ore and the other raw materials for steelmaking were his interests from the start, as he prepared for a career of mechanical engineering at the University of Michigan and took his first job with the M. A. Hanna Co. in 1914. He had become superintendent of the Hanna-operated Wakefield mine when the Inland Steel Co. drafted him in 1928 to take charge of its huge new limestone project near Manistique, Mich. In the years that followed, he not only brought the project into successful operation, but also played an important role in the acquisition and development of Inland's iron ore reserves, including the great Caland Ore Co. project at Steep Rock Lake, Ont. At the time of his retirement, he was president of both Caland Ore Co. and the Inland Lime & Stone Co., wholly-owned subsidiaries of Inland.

In his community, Manistique, and in his native state of Michigan, Fred Cayia gave generously of his time and talents to civic affairs.

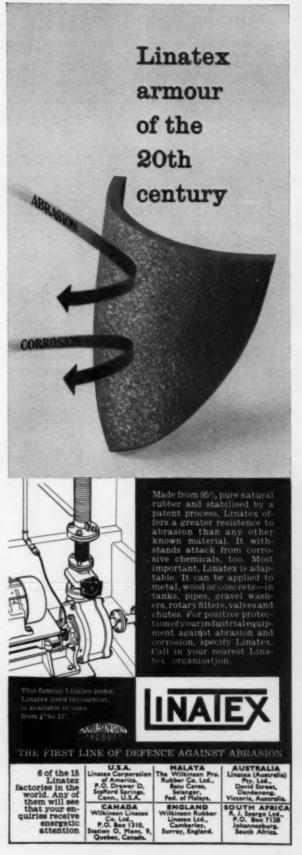
As one-time mayor of Manistique, and as a respected citizen, his influence helped shape the area's growth and development during the difficult period of transition between the decline of lumbering and the advent of other industry.

Fred's devotion to his profession and the warm friendliness which was felt by all who knew and worked with him, will long be remembered.

Harold L. Alling (Member 1919) died last July at the age of 72. A native of Rochester, he attended both the University of Rochester and Columbia University. His first professional assignment after finishing his graduate work at Columbia was as a special investigator, Dept. of Economic Geology, N. Y. State Survey. He then became geologist at the N. Y. State Museum in Albany. In 1920 he joined the staff of the University of Rochester as an instructor in geology. By 1926 he was head of the department. His association with the University continued until his retirement in the mid-1950's.

Bert C. Austin (Member 1927) died recently in San Francisco. He was born in Sheridan, Calif. on Oct. 7, 1880 and attended the University of California. His professional activities were carried on in the Pacific Northwest. Some of the companies he was associated with were

(Continued on page 915)



# SME PREPRINTS AVAILABLE — 1961 Annual Meeting, St. Louis

The following list of papers (from the 1961 St. Louis Annual Meeting) will be available until January 1962. Coupons (blue) received with the 1961 Dues Bills and those distributed at the Annual Meeting will be honored until Dec. 31, 1961. Purchased coupon books (yellow) will be honored at any time. As more preprints become available they will be added to this list and bulleted (•).

Preprints may be obtained (upon presentation of properly filled out coupons) from Preprints, SME Headquarters, 29 W. 39th St., New York 18, N. Y. Additional coupon books can be obtained from SME for \$5 (book of ten) to members or \$10 (book of ten) to nonmembers. Each coupon entitles purchaser to one paper. Please do not use coupons for papers other than those listed by number.

Bowman, E. V., and Hurst, E. J.: Material Handling Aspects of Fine Coal Cleaning,

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61F8.

Hightower, T. R., and Mellor, M. W.:
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Miller, J. W.: Economic Justification for
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Division of National Miller, J. W.: Economic Justification, Froth Flotation, 61F66.

Mongan, C. E., Jr., and Miller, T. C.: Use of Sonic Techniques in Exploring Coal-Mine Roof Strata, 61F33.

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## **Obituaries**

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Bunker Hill in Kellogg, Idaho; Amador Co.'s Oneida mine in California: the Britannia mines, British Columbia; Mt. King Mine, California; and Austin, Gamble & Wilson, San Francisco. In later years he had a consulting office in San Francisco.

R. H. Channing (Legion of Honor Member 1897), retired president of the Hudson Bay Mining & Smelting Co., died at his home in Tucson, Ariz., April 1, 1961. He was born Jan. 7. 1868 in New York City. While attending Princeton University he was a star halfback and was named to the first All-American team in 1889. Early in his career he had a mining and civil engineering practice at Bessemer, Mich., and subsequently worked as superintendent for Northern Mining & Smelting Co., Iron Mt., Mich.: mine foreman Canton mine: superintendent Norman mine, Mesabi Range, Minn.; and manager of Genoa mine, also in the Mesabi Range. In 1899 he went to Utah to become superintendent at Highland Boy mine. In 1901 he became manager of Utah Consolidated Mining Co. In later years Mr. Channing was president of Cerro de Pasco Copper Co. in Peru and the Utah Consolidated Copper Co. As a mining engineer, he was instrumental in developing copper and zinc mines in Canada.

Arthur J. Rice (Member 1931) died March 31, 1961, at the Norman Nursing Home, Johannesburg, S. Africa, after a long illness. He was born in Butte, Mont., on April 18, 1908 and received his professional education at the South Dakota School of Mines. His first job was as a surveyor and sample assayer for Black Hills Tin Co. In 1938 he joined Homestake Mining Co. as a laborer, working up to cost engineer before leaving to join the army during World War II. Following the war he went back to Homestake as cost engineer. He remained with the company until the mid-1950's when he went with the Atomic Energy Commission in Grand Junction, Colo. By 1959 he had gone to S. Africa to work for Caloined Products Pty. Ltd. where he remained until his death.

### Necrology

Elected Name

Joseph H. Brennan Cecil W. Dannatt Albert Huber J. A. Jameson J. B. Jenkins Glen R. Neighbors Mac D. Oliver, Jr. Geo. W. Roddewig John K. Wright

Date of Death

Apr. 19, 1961 Unknown Unknown Jan. 17, 1961 Unknown Unknown Unknown Mar. 15, 1961 Mar. 4, 1961

# Membership

Proposed for Membership

Society of Mining Engineers of AIME

Total AIME membership on May 31, 1961, was 34,870; in addition 2,038 Student Members were enrolled.

ADMISSIONS COMMITTEE

ADMISSIONS COMMITTEE

S. S. Cole, Chairman; F. A. Ayer; F. Wm.
Bloecher; H. L. Brunjes; I. A. Given; R. T.
Lassier; R. J. Middlekauf; L. T. Warriner;
G. W. Wunder.
The Institute desires to extend its privileges to every person to whom it can be of service, but does not desire as members persons who are unqualified. Institute members are urged to review this list as soon as possible and immediately to inform the Secretary's office if names of people are found who are known to be unqualified for AIME nembership. membership.

### Members

Max R. Ahrens, Denver
Paulo A. Andery, Sao Paulo, Brazil
George A. Berlin, Denver
Frank V. Colombo, Price, Utah
Bruno Dalia Corte, Sunnyside, Utah
Bob E. Daugherty, Platteville, Wis.
Raymond T. Dent, Spruce Pine, N. C.
George J. Dole, St. Louis
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Hellmut M. Gabler, Knapsack bei Koln,
Germany Hellmut M. Gabler, Khapsack ber Germany Floyd L. Glaze, Praco, Ala. James A. Hamilton, Red Bank, N. J. Alfred E. Haswell, Toronto George A. Hoffman. Lima, Peru Charles H. Kline, Pompton Lakes, N. J. Thomas W. Knight, Mohawk, Mich. Leo Komar, Grants, N. M. LaMar T. Lindsay, Sunnyside, Utah John W. Lyons, St. Louis Dari C. McLean, Gagnon, Que., Canada Robert T. Magers, Lead, S. D.

Neal Myers, Birmingham
Kenneth O. Olien, Moab, Utah
K. G. Rao, Orissa, India
Robert F. Schirmer, Grants, N. M.
Peter Sharp, Pitcairn, Pa.
Floyd B. Tucker, Sunnyside, Utah
Lincoln C. Varco, Seattle
Walter G. Verner, Jr., Grand Junction, Colo.
Dale E. Walker, Steeleville, Ill.
William G. Wegenast, Pointe Claire, Que.,
Canada

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Darrell E. Spilde, Hulett, Wyo.
Raymond J. White, Jr., Pittsburgh
Orlando I. Zambrano, Puerio Ordas, Venezuela

### CHANGE OF STATUS Associate to Member

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### REINSTATEMENT Associate

Myron Geller, Cleveland Heights, Ohio

Junior

Paul A. Main, Jefferson City, Tenn William H. Wahl, Richmond, Calif.

### REINSTATEMENT—CHANGE OF STATUS Associate to Member

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Junior to Member

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In addition to the latest, most modern drilling machines and equipment, we have tools and techniques not generally available. For Example: Where our customer's primary concern is an "on-course" hole, we have our Craelius Drill Hole Survey Instrument to guide us. On deep hole work our ability to deflect holes and accurately control their new direction has saved our customers money by eliminating the need for additional holes from the surface. Using our "Frozen-Core Technique" we have successfully recovered 98% core in sand and siltstone where others had previously recovered only 60 to 65%.

Ours is not "just an ordinary service" . . . When you are plan-ning your next exploratory drilling project, give us an opportunity to show you how well we can serve you.



# SPRAGUE & HENWOOD, Inc. SCRANTON 2, PA.



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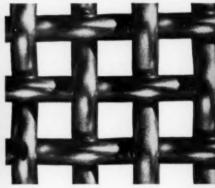
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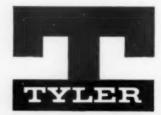
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